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DEPARTMENT OF THE INTERIOR
Julius A. Krug, Secretary

FISH AND WILDLIFE SERVICE
Albert M. Day, Director

CONFERENCE OF DIVISION OF FISHERY BIOLOGY
January 27 to 31, 1947
Washington, D. C.

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CONFERENCE OF DIVISION OF FISHERY BIOLOGY

January 27 to 31, 1947

Washington, D. C.

The meeting was called to order by Mr. Higgins at 10:00 a.m. January 27, 1947, and he called the roll.

ROLL CALL

Members of the Division

- Mr. Elmer Higgins, Chief of Division, Washington, D. C.
Mr. Paul Thompson, Assistant Chief of Division, Chicago, Illinois
Dr. Georga A. Rounsefell, Assistant to Chief of Division, Washington, D. C.
Dr. Willis H. Rich, Consultant, Salmon Research, Stanford University, California
Mr. George B. Kelez, Chief of Alaska Section, Seattle, Washington.
Mr. Joseph T. Barnaby, Chief of Section, North Pacific Investigations, Seattle, Washington
Mr. W. W. Anderson, Chief of Section, Gulf of Mexico Fishery Investigations, New Orleans, Louisiana
Mr. William C. Neville, Chief of Section, Middle Atlantic Investigations, Milford, Connecticut.
Dr. John Van Oosten, Chief of Section, Great Lakes Investigations, Ann Arbor, Michigan
Dr. Charles M. Mottley, Chief of Section, Eastern Inland Fishery Investigations, Washington, D. C.
Dr. Frederic F. Fish, Chief of Section, Western Fish Cultural Investigations, Corvallis, Oregon
Dr. James W. Moffett, Chief of Section, Southwest Inland Fishery Investigations, Palo Alto, California
Dr. Paul S. Galtsoff, Chief of Section, Shellfish Investigations, College Park, Maryland
Dr. Samuel F. Hildebrand, In Charge, of Ichthyological Laboratory, U. S. National Museum, Washington, D. C.
Dr. Elbert H. Ahlstrom, Project Leader, South Pacific Investigations, Stanford University, California
Dr. William F. Royce, Project Leader, North Atlantic Investigations, New Bedford, Massachusetts
Dr. Aubrey E. Hopkins, In Charge of Laboratory, Shellfish Investigations, Pensacola, Florida
Dr. Victor L. Loosanoff, In Charge of Laboratory, Shellfish Investigations, Milford, Connecticut
Mr. Eugene W. Surber, In Charge of Research Laboratory, Leetown, West Virginia
Dr. James Gutsell, Project Leader, Leetown, West Virginia
Dr. Ralph Hile, Project Leader, Great Lakes Fishery Investigations, Ann Arbor, Michigan
Mr. Thomas K. Chamberlain, Project Leader, Eastern Inland Fishery Investigations, College Station, Texas
Dr. C. J. D. Brown, Project Leader, North Pacific Fishery Investigations, Clackamas, Oregon.

Mr. James B. Engle, In Charge of Laboratory, Shellfish Investigations, Annapolis, Maryland

Mr. Samuel J. Hutchinson, Project Leader, Alaska Investigations, Seattle Washington

Dr. Stanislaus Snieszko, Project Leader, Eastern Inland Fishery Investigations, Leetown, West Virginia

Dr. Paul Arne Hansen, In Charge, of Hampton Research Laboratory, Shellfish Investigations, Hampton, Virginia

Dr. W. A. Chipman, Jr., Project Leader, Shellfish Investigations, College Park, Maryland

Miss Louella Cable, Project Leader, Middle Atlantic Investigations, College Park, Maryland

Mr. Isaac Ginsburg, Ichthyological Laboratory, College Park, Maryland

Dr. Philip A. Butler, Shellfishery Investigations, Annapolis, Maryland

Mr. Edgar Hollis, Middle Atlantic Investigations, College Park, Maryland

Miss Helen Landau, Shellfishery Investigations, College Park, Maryland

Mr. Wm. C. Herrington, Chief of Section, North Atlantic Investigations, Cambridge, Massachusetts (attended on January 28 to 30)

Dr. M. M. Ellis, Chief of Section, Water Quality Investigations, was absent on account of illness in his family

Dr. Oscar E. Sette, Chief of Section, South Pacific Investigations, was unable to attend on account of illness.

Dr. Arthur M. Phillips, Jr., was absent because of an addition to his family.

Interested Members of the Service

Mr. Albert M. Day, Director, Washington, D. C.

Dr. Clarence Cottam, Assistant Director, Chicago, Illinois

Mr. Milton C. James, Assistant Director, Washington, D. C.

Dr. Gustav Swanson, Chief of Division of Wildlife Research, Chicago, Ill.

Mr. Andrew W. Anderson, Chief, Division of Commercial Fisheries

Mr. Seton H. Thompson, Assistant Chief, Alaska Division

Dr. Lionel A. Walford, Assistant Chief, Division of Information

Mr. Fred Johnson, Assistant Chief, Division of Commercial Fisheries

Mr. Frederick C. Lincoln, Assistant to the Director

Mr. Edward A. Power, Chief, Statistical Section, Division of Commercial Fisheries

Mr. Wm. H. Dumont, Chief, Market News Service, Division of Commercial Fisheries

Mr. James M. Lemon, Chief, Technological Section, Division of Commercial Fisheries

Dr. Richard A. Kahn, Chief, Economics Section, Div. of Comm. Fisheries

Mr. Richard T. Whiteleather, Chief, Educational Sec., Div. of Comm. Fisheries

Mr. J. R. Webster, Fishery Technologist, Office of Foreign Activities

Guests who attended briefly

Mr. Charles E. Jackson, National Fisheries Institute, Washington, D. C.

Mr. Wayne D. Heydecker, Secretary-Treasurer, Atlantic States Marine Fisheries Commission

Mr. Richard Reed, Commissioner of Sea and Shore Fisheries, State of Maine.

Addresses by Director Albert M. Day, Assistant Director Clarence Cottam, & Division Chief Elmer Higgins are presented in the appendix to these minutes

The meeting adjourned at 12:15 p.m.

MONDAY AFTERNOON, JANUARY 27, TOPIC: RESEARCH

The meeting came to order at 1:00 p.m. Dr. Rich acted as chairman and led the discussion.

Dr. Galtsoff defined research in a philosophical vein and concluded that the Service should conduct the basic research necessary to the understanding of the laws of nature and their application in the conservation of our aquatic resources.

Dr. Mottley discussed the four principal steps of a research project and the detailed operations in each as follows:

"THE PATTERN OF INQUIRY"

STAGES AND OPERATIONS

Exploratory stage

1. Become aware that inquiry is needed
2. Make a diagnosis of the cause of uncertainty
3. Decide whether to undertake inquiry and if so assign priority

Preliminary Investigative Stage

4. Develop necessary techniques, plans and sampling procedures
5. Make observations and collect data
6. Analyze and determine the particular problems to be solved
7. Develop reasonable explanations of state of affairs

Investigational or Experimental Stage

8. Design a test of the explanation
9. Conduct the test, observe, and record results
10. Judge the significance of the results
11. Communicate the findings for the judgment of others and for use

Follow-up Stage

12. Follow-up to determine the adequacy of the findings.

A lively discussion followed in which all participated. Meeting adjourned at 5:25 p.m.

TUESDAY MORNING, JANUARY 28, TOPIC: ORGANIZATION

The meeting was called to order at 9:30 a.m. Mr. Kelez was chairman, and presented at some length and in detail a plan for Divisional reorganization worked out by the discussion leaders, Mr. Kelez, Dr. Moffett, and Mr. Anderson. The presentation of this plan was in line with the earlier statements of both Dr. Cottam and Mr. Higgins that Divisional reorganization, delayed several years by the war, was overdue.

The plan presented by the Committee called for:

The Chief of the Division-

Assistant Chief for Administration

Technical Assistant for Invertebrates

" " Fresh-water fisheries

" " Anadromous fisheries

" " Pelagic marine fisheries

" " Bottom marine fisheries

Field organization to be geographical, as follows;

Northeast section

Southeast section

Northwest section

Southwest section

Central section

Alaska section

Mr. Higgins presented two additional proposals for reorganization. The discussion was lively and it was decided to defer further discussion until the committee brought in its report on Friday.

TUESDAY AFTERNOON, JANUARY 28, TOPIC: RESEARCH PROGRAM

The meeting was called to order at 1:00 p.m. and Mr. Barnaby led the discussion group, consisting of himself, Mr. Herrington, and Dr. Mottley, acting for Dr. Phillips, who was unable to attend, in a discussion of research programs.

There was a great deal of discussion of the factors to be considered in determining the priority of a research program. Some of the factors discussed were:

Value of the resource in dollars

Food value

Recreational value

Management needs

Contribution to science

Poundage taken

Urgency in point of time

Possibility of practical applications

Strategy

It was brought out that there should be a balance between long-term and short-term projects. There was general agreement that even long-term projects should be broken down in such a way that segments of the work could be completed from time to time. 4

There was discussion and general agreement on the desirability of having a medium of publication, probably a quarterly journal by the Service, especially for publication of short papers and progress reports.

TOPIC: TECHNICAL STANDARDS

At 3:00 p.m. the Session on Technical Standards was called to order led by Dr. Galtsoff (chairman) and Dr. Fish. There was lively discussion of the need for classification of research positions independently of administration duties. Mr. Higgins explained that the Civil Service Commission was now fully cognizant of this need and was encouraging such procedure, the real need was to explain to the personnel divisions of various agencies the Civil Service attitude on this question. A committee was appointed to draw up a resolution on library needs. The meeting adjourned at 5:30 p.m.

WEDNESDAY MORNING, JANUARY 29, TOPIC: ADMINISTRATIVE PROBLEMS

The meeting was called to order at 9:40 a. m. The session on Administrative Problems was led by Mr. Paul Thompson (chairman), Mr. Neville and Dr. Hile.

There was a long discussion of the growing burden of "red tape" and its effect in lowering the quantity of research achieved. Various remedies were suggested such as elimination of unnecessary reports, consolidation of field units, and appointment of administrative assistants.

The need for a simplified system of cost accounting was stressed as it would enable each section chief to see where his funds were going, and to measure outlay against the output of scientific knowledge.

Dr. Cottam emphasized the importance of careful and objective efficiency ratings, especially for probational employees.

A divisional manual was discussed critically on the grounds of the possibility that it would be repetitious of the Field Manual of General Administration. The meeting adjourned at 12:00 noon.

WEDNESDAY AFTERNOON, JANUARY 29, TOPIC: REVIEW OF DIVISIONAL PROGRAM

The meeting was called to order at 1:00 p.m. and the Session on Review of the Divisional Program was led by Dr. Rounsefell (chairman), Dr. Galtsoff, and Dr. Mottley. They comprise the Technical Planning and Coordination Committee of the Division.

Dr. Rounsefell gave a brief analysis of the 1947 research program presenting an attempt at mathematical evaluation of projects and personnel of each section. Since the assignment of priorities to each project and subproject was subjective and the weighting of personnel was arbitrary, many objected to the conclusions that several sections were over-manned or that, in other cases, the work program was too broad. It was also pointed out that the several section chiefs employed different bases for breaking down their programs into projects and subprojects and that this invalidated the weightings used and the specific conclusions.

(Editorial Note: There is great difficulty and little uniformity in the definition of "assigned objectives", subprojects or projects. The literature on research management gives little help. Nevertheless, the organization of the research program of the Division requires such definition on a more uniform basis and a more objective assignment of priorities to each unit of the work program. Since Dr. Rounsefell's paper presents an attempt to make such evaluations, using admittedly imperfect data and subjective determinations which invalidate the specific conclusions regarding each section, it is presented in the appendix to these minutes in the hope that a valid method of appraisal can be developed in the future. Section Chiefs should present future programs with their own estimates of priority carefully worked out and compared with personnel needs, time for completion and estimated costs and benefits for approval.)

Each section^{chief} was asked to explain his program and the Committee then questioned him.

Alaska Section. It was brought out by Mr. Kelez that the Alaska Section is greatly understaffed. The very important red-salmon fishery in Bristol Bay cannot be properly studied, yet because of the Service's responsibility for management, knowledge is sorely needed. The salmon packers have embarked on a research program of their own because of the Service's failure to show concrete achievements. During 1946 they have expended \$60,000 on salmon research which is slightly larger than the amount spent by the Service on salmon and herring research (exclusive of course of funds spent on the new stream improvement program).

North Pacific Section. Mr. Barnaby explained that the chief problem of this section is how to save the salmon runs in the face of immediate dam construction. The personnel and funds situation is so complicated by the recent setup of a River Basin unit that the morale of the staff is low.

South Pacific Section. Dr. Ahlstrom explained the work on pilchards. Although research on pilchards is being done by California and British Columbia, there is no duplication of effort. The paramount needs are a research vessel for oceanic studies.

Gulf of Mexico Section. Mr. W. W. Anderson stressed the impossibility of pretending to cover the problems of South Atlantic and Gulf Coasts with only two men. The need for a permanently signed pollution expert is acute, as is the need for a shallow-draft inshore research vessel.

Middle Atlantic Section. Mr. W. C. Neville reported that this section is in process of being combined with the North Atlantic Section and that only the blue crab and shad studies will be continued.

Meeting was adjourned at 5:15 p.m.

THURSDAY MORNING, JANUARY 30, TOPIC: REVIEW OF DIVISIONAL PROGRAM, contd.

The meeting was called to order at 9:30 a.m. Mr. Charles E. Jackson, of the National Fisheries Institute, addressed the group briefly. The meeting then continued with the Review of the Divisional Program.

North Atlantic Section. Mr. Herrington outlined the work of this section, putting especial emphasis on continued collection of data. He did not explain the failure to meet deadlines for reports. He thought oceanographical observations were not as urgent as some other phases of the work.

Shellfish Investigations. Dr. Galtsoff presented the work of the Shellfish Section and explained that personnel was adequate with the exception of the need for personnel at the Pensacola laboratory.

Dr. Galtsoff made an eloquent plea for the restoration of the Woods Hole Station. The chairman appointed Dr. Rich (chairman), Dr. Walford, and Dr. Galtsoff as a committee to draw up a resolution on Woods Hole. The meeting adjourned at 12:00 noon.

THURSDAY AFTERNOON, JANUARY 30, TOPIC: REVIEW OF DIVISIONAL PROGRAM, contd.

Meeting was called to order at 1:00 p.m.

Eastern Inland Fishery Investigations: Dr. Mottley outlined the program for the Section and emphasized that the section now has 6 investigators, whereas it had 12 before the war. With the present small staff, it is possible to carry on a limited program of laboratory studies, but not possible to adequately cover the field studies needed for management. Reports are up to date and several more are in process of preparation.

Southwest Inland Fishery Investigations. Dr. Moffett explained that this section is working chiefly on mitigation of losses to anadromous fishes that are threatened by the construction of dams in the central valley of California. There exists an unfilled need to supply the Forest Service with information on trout management in National Forests. If this is not supplied, the Forest Service will have to set up its own fishery staff. This section is adequately staffed for its present program.

Western Fish Cultural Investigations. Dr. Fish's section is working exclusively on salmon cultural methods. The chief problem is to determine to what extent artificial propagation can replace the natural spawning that will be curtailed by dam construction. The lack of a suitable substitute for liver, which is already too high priced and in too short supply is a critical factor. Because of the imminence of dam construction the time element is very important.

Water Quality Section. Because of Dr. Ellis' absence, the program was not outlined. Several section chiefs expressed the need for a pollution expert on their staffs, to take care of important problems not now being given adequate consideration.

Ichthyological Laboratory. Dr. Hildebrand outlined the service functions performed in identifying fishes submitted by various agencies. He mentioned the various reports now being prepared. As a great deal of work is entailed and the bulk of the reports cover foreign fields it was suggested that the Office of Foreign Activities might provide Dr. Hildebrand with an assistant to relieve him of much of the heavy burden of making detailed counts and measurements.

Great Lakes Section. Because of the shortage of time Dr. Van Oosten gave only a brief outline of the work. The meeting adjourned at 3:00 p.m. to give the committees a chance to meet. (The full text of the Great Lakes Program, by Dr. John Van Oosten and Dr. Ralph Hile, is appended at the end.)

FRIDAY MORNING, JANUARY 31, TOPICS: REPORTS OF COMMITTEES

The meeting was called to order at 10:10 a.m. Dr. Higgins, as chairman, asked for presentation of the reports of the Committees.

Dr. Mottley read the report for the Committee on Research:

REPORT OF THE COMMITTEE ON RESEARCH

Committee Members: Dr. Rich (chairman)

Dr. Galtsoff

Dr. Mottley

Dr. Brown (recorder)

A - Fields of Research

Research is not only a collection of facts but the analysis and synthesis of data to the end that some problem may be solved. This problem may be either in the field of pure science or in that of applied science. Research may serve to develop a principle or serve as a basis for action. Research provides that constant flow of knowledge that is essential to human and national welfare.

It is necessary for the work of the Division to go beyond pure research because of the justifiable demand for the solution of practical problems that are presented to every Governmental agency. Although these service functions are necessary it is highly desirable that they be not permitted seriously to interfere with the more important function of fundamental research. It seems impossible to define the "fields" in which the Division should "conduct applied research" or "perform reconnaissance or development activities" other than to say that they should apply to problems of fishery management.

Operational services should not be a function of the Division although it may frequently happen that supervision by research men is at least desirable. Public demands for operational services will, of course, be met by the appropriate Governmental agency advised, if necessary, by members of the Divisional staff.

There can be no sharp dividing line between the functions of the Division of Fishery Biology, and the Divisions of Wildlife Research, Commercial Fisheries, Game Fish and Hatcheries, and Alaska Fisheries.

B - Cooperative Research

There are frequent opportunities for cooperative research with other agencies, Federal, State, and private. In general, cooperative research is commended; but it is necessary to exercise due caution in engaging in cooperative research with private agencies. In the matter of the collection of fisheries statistics it is desirable that this be done by whichever division is in the best position to collect statistics of the kinds that will satisfy all needs of the Service at the least cost.

Contract Research by other agencies may often be highly desirable and economical.

C - Conditions for Research

The following conditions would favor research within the Division of Fishery Biology:

1. Closer contact between the several field units and between the field units and the Central Offices
2. Direct contact with universities or other research organizations
3. Opportunity for advancement within the organization
4. Privilege of attending appropriate scientific meetings
5. The delegation of "trouble shooting" jobs to certain staff members hired for that purpose, thus leaving the researcher uninterrupted opportunity
6. Prompt handling of scientific papers

The following conditions would tend to hinder research within the Division of Fishery Biology:

1. The overload of administrative matters (red tape).
2. Improper recognition of participating staff members and lack of opportunity for the men in the field to try out new ideas.
3. Lack of equipment and facilities

WHEREAS, administrative procedure—known popularly as "red tape," in recent years has been growing in the Fish and Wildlife Service out of all proportion to the requirements of carrying on the orderly business of Government;

AND WHEREAS, this growth is interfering increasingly with the proper functions of the Fish and Wildlife Service, especially with the Fishery Research programs;

AND WHEREAS, the rules, orders, memoranda, etc., have never been well organized or systematized, and are difficult to understand;

AND WHEREAS, it is now necessary to hire special and experienced clerks to cope with the mass of administrative procedure; and the money spent could be better used elsewhere;

AND WHEREAS, the elimination or reduction of said red tape to a minimum would have a very salutary effect both on the quality and quantity of the research work being done;

BE IT RESOLVED that the Director be urged to investigate the administrative procedure of the Fish and Wildlife Service as it applies to the Division of Fishery Biology with a view to streamlining it, systematizing it, and reducing it so far as possible.

The report of the Committee was adopted unanimously.

The report of the Committee on Organization was read by Mr. Kelez as follows:

REPORT OF THE COMMITTEE ON REORGANIZATION

Committee Members: Mr. Kelez, (chairman)
Dr. Moffett
Mr. Anderson
Mr. Hutchinson (recorder)

The following plans for reorganization of the Division were presented and discussed on January 28 with no apparent consensus of opinion having been reached:

PLAN I. (Presented by the Committee)

The Central Office to consist of a Chief, an Assistant Chief for administration, and of five Assistants to the Chief, selected with respect to the following subjects:

1. Anadromous
2. Invertebrates
3. Fresh water
4. Marine Bottom
5. Marine Pelagic

These assistants to function as a committee.

The Field Organization to consist of the following six sections divided by area.

1. Northeast
2. Southeast
3. Southwest
4. Northwest
5. Central
6. Alaska

PLAN II. (Submitted by Mr. Higgins)

Central Office to consist of a Chief and three Assistant Chiefs responsible individually for

1. Administration
2. Inland fisheries
3. Marine fisheries

No change in the present Field Organization

PLAN III. (Submitted by Mr. Higgins)

The Central Office to consist of the Chief, an Assistant Chief for Administration, and four Technical Chiefs:

1. Inland
2. Oceanic fisheries (offshore)
3. Littoral (inshore)
4. Anadromous

The administration of the Field Sections would be as follows:

- a. Reporting directly to the Chief-
 1. Alaska Section
 2. Ichthyological Laboratory
 3. Beaufort Laboratory
- b. Reporting to the Inland Technical Chief-
 1. Eastern Inland Section
 2. Western Fish Cultural Section
 3. Southwestern Inland Section (inland part)
 4. Great Lakes Section
 5. Water Quality Section
- c. Reporting to the Oceanic Technical Chief
 1. South Pacific Section
 2. North Atlantic Section (marine part)
- d. Reporting to the Littoral Technical Chief
 1. Middle Atlantic Section (marine part)
 2. Shellfish Section
 3. Gulf of Mexico Section
- e. Reporting to the Anadromous Technical Chief
 1. North Pacific Section
 2. Southwest Inland Section (anadromous part)
 3. Atlantic Salmon
 4. Shad and Striped Bass

Several suggestions were made from the floor. One plan proposed organization by three areas-

1. Atlantic
2. Pacific
3. Fresh water or Interior

Another proposed that the marine fisheries be divided into inshore and offshore.

It was also proposed that the assistants in the Central Office function on a geographical basis rather than on that of subject matter. Additional plans were later proposed that the Central Office function for the purpose of basic administration and policy only, and that the field sections be re-grouped into large geographical units with full autonomy except on matters of broad policy.

The basic unit of the research program of the Division is the research project, possibly defined as a program which includes all planned phases of work relating to one resource, species or special subject as the case may be, and which is in turn broken down into specific objectives or assignments. The procedure of assigning definite objectives to a project appears both desirable and necessary, since it directs the activities of the research worker toward certain definite ends which have previously been determined as necessary. At the same time, supervision is simplified and a determination of progress on the assignment made easier.

The grouping of projects into field sections has several advantages:

- (1) It tends to concentrate all projects dealing with the resources of an area into a group where coordinated work and assistance is possible. This, within the section, at least, tends toward a better planning of the program and eliminates duplication of effort.
- (2) Without the field sections or units, the central office instead of dealing with the relatively few sections would have to have direct contact with all of the research projects on an individual basis.
- (3) From an administrative point of view, the grouping of projects into sections is a decided advantage. Regardless of the size of the individual field unit, there is a considerable amount of administrative procedure and paper work involved. If this job can be largely delegated to one person for a group of projects, then much time and effort can be saved.

The personnel assigned to any given project should be a number sufficient to carry out concentrated work on all assigned objectives. If a research worker is forced to divide his time between several objectives, each of which would ordinarily require his full time, then progress on all is likely to be seriously hampered and, at the same time, the results obtained will not be as satisfactory as could be accomplished if sufficient personnel were working. Two courses of action are possible when the staff of a project is found to be inadequate to allot sufficient time to each objective in order to assure proper progress:

- (1) Increase the number of workers.
- (2) That being impossible, it would appear advisable, in many instances, to reduce the assignments to a level at which the available personnel could carry on concentrated work on the remainder.

There are several advantages in grouping several projects into a coordinated research program whether within an investigation, between investigations, between Divisions, or between agencies. This is particularly desirable when two or more groups are working on the same species or resource for several reasons:

- (1) Organization of work to achieve the greatest benefits with available personnel and funds
- (2) Interchange of ideas, methods and results
- (3) Avoids duplication of effort
- (4) Provides for a more harmonious relationship between groups with related interests

Certain of the above cooperative programs, however, often have the disadvantage of too much division of authority and responsibility leading to conflicts between ideas and personalities.

The various levels of personnel in the Division have definite duties and responsibilities.

Division Chief: The Division Chief is responsible for policy, planning and review of all activities of the Division. To discharge these duties he must have knowledge of the overall problems and need for investigations as between the various resources and regions in order to most adequately distribute funds and personnel to derive the maximum benefits. He should have a working knowledge of the entire research program enabling him to give constructive advice relative to each line of investigation.

Chief of Field Unit: To begin, this man should be thoroughly familiar with the resource or resources assigned to his field unit for investigation in order that the most efficient and desirable research programs can be outlined. In addition to carrying on such research as has been assigned to him, it is his responsibility to direct the various projects toward the assigned objectives and to give assistance and advice to the various project leaders or investigators within his unit as the case may be. He is responsible for keeping the Division Chief informed on program plans and progress as well as new developments which are occurring. The overall administrative problems of the section are the responsibility of this man. The section chief must work closely with the project leaders in planning and carrying out the various phases of the program.

Project Leader: The chief responsibility of the project leader is to see that his assigned program is adequately carried on. He must work in close cooperation with the chief of his field unit in the planning and conduct of his program. To maintain close supervision and render assistance to such investigators as may be under his direction is a major duty and responsibility. This man is also responsible for the general administrative problems of his unit.

Investigator: The duty and responsibility of this man is to diligently carry on such work as has been assigned to him. He should be alert and advise his superiors as to any apparently desirable changes in the program and new developments that may become known to him.

Subject Specialist: Aside from carrying out their own individual research such specialists, due to their training, should be available to the field units for work requiring their specialized knowledge as the need arises.

A duty and responsibility of all personnel of the Division is to cooperate with the various conservation groups interested in the results obtained from the research.

Dr. Mottley suggested from the floor as addition to the report as follows:

4. consideration of any program should include:

1. an assigned objective-
 - a. starting date
 - b. completion date
2. place of operation (geographic)
3. To what things in the situation will work be directed
4. methods of observation
5. conditions to be included
6. investigator and assistants specified by name
7. plan of operation
8. kind of report expected
9. costs

The functioning of any program should provide for revision at periodic intervals or as the findings produced might indicate."

The suggestion was added to the report by the Committee

The group voted to accept all of the report except the first part on reorganization which they wished to discuss at greater length.

A resolution was then read and adopted as follows:

RESOLUTION

Whereas the Division of Fishery Biology during the past 20 years has grown some ten-fold without corresponding growth in administration personnel and thus too heavy a burden has been placed upon the central staff-

And whereas close liaison between the field staffs and the central office has been impossible and the functions of the Division have therefore suffered-

And whereas it was the consensus of opinion among the Conference members that in the best interests of the Division this situation should be remedied-

Be it resolved that:

1. The Central Office of the Division be reorganized in such a manner as to remedy these situations.
2. That this reorganization should not be made at the expense of the existing field force.
3. The autonomy in the field should in no way be restricted by this reorganization.

The group then considered the first part of the report on reorganization, and suggestions were called for from the floor. After several more plans were advanced and discussed it was agreed by unanimous vote that neither a strictly geographical nor a strictly subject basis were acceptable; that any plan should represent a combination of these two factors. After elimination by this means of a portion of the plans, and modifying Plan I by unanimous consent to include "Shellfish" as a field Section, there remained five plans to be considered.

PLAN I

These were as follows: Central Office - Chief, Assistant Chief for Administration.

- Assistants on
1. Anadromous fish
 2. Invertebrates
 3. Freshwater fish
 4. Pelagic marine fish
 5. Bottom marine fish

Field - 7 sections

Northeast	Northwest	Central
Southeast	Southwest	Alaska
Shellfish		

PLAN II

Central Office - Chief

- Assistant Chiefs for
1. Administration
 2. Inland fisheries
 3. Marine fisheries

No change in field organization.

A continuation of the Coordination Committee

PLAN III

Central Office - Chief, Assistant Chief for Administration
Technical Chiefs for 1. Inland fisheries
2. Oceanic (offshore) fisheries
3. Littoral (inshore) fisheries
4. Anadromous fisheries

Field units to be set up as follows:

- a. Reporting directly to the chief - Alaska
Ichthyology Laboratory
Beaufort "
- b. Reporting to Inland Technical Chief
Eastern Inland
Western Fish Culture
Southwest Inland (inland part)
Great Lakes
Water Quality
- c. Reporting to Oceanic Technical Chief
South Pacific
North Atlantic (marine part except lobster)
- d. Reporting to the Littoral Technical Chief
Middle Atlantic (marine)
Shellfish (including lobster)
Gulf of Mexico
- e. Reporting to the Anadromous Technical Chief
North Pacific
Southwest Inland (anadromous part)

Atlantic salmon
Shad

PLAN VII

Central Office - Chief, Assistant Chief for Administration
Assistants for 1. East
2. West
3. Central
4. Alaska

Field to be reorganized on a subject basis

PLAN VIII

Central Office - Chief, Assistant Chief for Administration
Assistant Chiefs for 1. Inland fisheries
2. Marine (east coast and Gulf)
3. Marine (west coast and Alaska)

Field - 8 sections -

- 1. Atlantic
- 2. Gulf
- 3. Southwest Inland
- 4. Central Inland
- 5. Northwest Inland
- 6. Shellfish
- 7. West Coast Marine
- 8. Alaska

Everyone was polled as to their preference for each of the 5 plans, I, II, III, VII, or VIII

The results were:

<u>Section Chiefs</u>	<u>Plan No.</u>	<u>Others</u>	<u>Plan No.</u>
Galtsoff	1	Surber	3
Mottley	1	Snieszko	3
Moffett	7	Chamberlain	3
Barnaby	7	Gutsell	2
Kelez	7	Hile	7
Fish	7	Ginsburg	3
Anderson	7	Chipman	1
Neville	8	Hansen	1
Ahlstrom	7	Brown	7
Van Oosten	8	Loosanoff	1
Royce	1	Engle	1
Hildebrand	3	Hutchinson	7
		Hopkins	1
		Cable	3
		Rounsefell	1
		Thompson	7

<u>Votes</u>	<u>Plans</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>7</u>	<u>8</u>
Section Chiefs		3	0	1	6	2
Others		6	1	5	4	0
Totals		9	1	6	10	2

The Report of the Committee on a Research Program was read by Mr. Barnaby as follows:

REPORT OF THE COMMITTEE ON RESEARCH PROGRAM

Committee Members: Mr. Barnaby (chairman)
 Mr. Herrington
 Dr. Mottley
 Dr. Chipman (recorder)

In the choosing of a research program, the duties and responsibilities of the agency carrying on the research must be kept in mind. The Fish and Wildlife Service is responsible, by statute, for investigating the fishery resources of the United States, and is particularly responsible for conducting research on the fishery resources in the territories, in areas where several States are involved, and in areas where the construction of impoundments by the Federal Government, or under Federal Government license, might have an effect on the fishery resources.

Various factors, other than responsibility, have an influence on the choosing of a research project such as local interest, political demand, economic crisis, sequence of scientific need, and Service policy. The relative effects of these several factors varies from project to project. One of the weaknesses of the Service's programs is that all too often they are based on emergencies. Frequently appropriations are obtained for a given project for a year or two and then are greatly reduced or eliminated entirely. This seriously impairs the research program and the achievement of the objective.

Research work should be planned and carried on in such a manner as to provide fundamental information. This usually means that the projects will be of a "long-time" nature. Some "short-time" projects must, of course, be carried on. In fact, the research program should be planned to include both short time and long time projects. The short time projects, if properly planned, can be segments of the long time projects.

We usually study individual species but certain fundamentals have a bearing on all species. For clarity, projects are limited, usually, to one species, but the community of species should always be kept in mind.

It was brought out during the discussion that the following general steps are usually followed in planning a project: (1) Field reconnaissance, (2) study of literature, (3) realization of the problem involved, (4) planning of experimental design, and (5) scheduling of operations. Costs, probable benefits, duration of the project, and the manner of dissemination of the information obtained should be given careful consideration during the planning stage.

The following factors should be thoroughly considered in determining the priority of projects: (1) Statutory requirements, (2) how the results will answer fundamental questions in the biology of the species, (3) how the problem fits into the conservation plan, (4) economic crisis, (5) political pressure and political expediency, (6) value of the fishery, including extent, poundage, and monetary return including recreational values. No rule of thumb method can be used, the priority of a project can only be used on the considered opinion of the Section and Division Chiefs.

While objectives are reached, research is never finished. A well planned project should be divided into several definite objectives without, of course, losing sight of the objective of the project or program as a whole. Decision as to when a project or program should be terminated is a matter of judgment based on such factors as: when the objective has been reached, when a re-evaluation of the problem indicates that the project can no longer be carried on with benefits commensurate with the costs, or when funds are no longer available to carry on the project in a satisfactory manner. A project is not really completed until the results are made available to all those concerned. It was the consensus that better facilities for the dissemination of the results should be made available.

The report was unanimously approved as submitted.

The report of the Committee on Technical Standards was read by Dr. Galtsoff, as follows:

REPORT OF COMMITTEE ON TECHNICAL STANDARDS

Committee Members: Dr. Galtsoff (chairman)

Dr. Fish

Dr. Royce (recorder)

PERSONNEL

Training of prospective employees in fishery biology should be encouraged by participation of Service personnel in teaching and university activities wherever possible; by fellowships to aid graduate study; and by summer employment of students.

Cooperative units of States

College - State Conservation Departments - Fish and Wildlife Service - organizations to aid in training fishery biologists should be formed where possible. Due consideration should be given to balancing the number of students with the number of jobs available.

Present personnel of the Fish and Wildlife Service should be encouraged to the limit of the means available to attend scientific meetings, to participate in seminars on biology and fishery problems, and to take advanced courses in special disciplines.

The conference expresses great concern regarding the lowered standards of the Civil Service Commission for the P-1 grades. In view of the present standards the conference considers it essential to use great care in approving permanent appointments after the probationary period.

Library needs

The Conference adopted the following resolution:

RESOLUTION

WHEREAS the library of the Fish and Wildlife Service is an essential tool of the research units; and

WHEREAS the librarian has no funds with which to purchase new acquisitions, and must beg contributions from Division Chiefs for each purchase; and

WHEREAS this is an ineffectual and inefficient means of conducting a National library, with the result that our library is unable to remain abreast of scientific literature in the field of conservation of fish and wildlife and related subjects;

BE IT RESOLVED that the Director be urged to set aside annually a fund of not less than \$3,500 to be administered by the Director of the Library for the purchase of books and serials.

Publications

It was the consensus that it is the duty of the section head to review papers submitted by project leaders and to forward them to the Chief of the Division for further review. However, in case of disagreement the authors must have the privilege of submitting the manuscript directly to the Chief of the Division or Director.

Standards of quality should be determined in the Division. The Editor in Chief should be concerned primarily with technical aspects of editing of manuscripts for printing, with grammar, style, etc., and not with the scientific soundness of papers.

This report and resolution were unanimously adopted.

The report of the Committee on Administrative Problems was read by Mr. Thompson, as follows:

REPORT OF THE COMMITTEE ON ADMINISTRATIVE PROBLEMS

Committee Members: Mr. Thompson (chairman)

Mr. Neville

Dr. Hile

Dr. Loosanoff (recorder)

1. Fiscal Problems. Limitations of funds make necessary the careful examination of all claims against the Division's appropriations. Allocations to individual projects are based upon the following principal considerations:

a. Production of fish and dollar volume; position of the fishery in the economic organization of the region.

b. Status of the fishery; trends of production; evidences of depletion or of excessive and wasteful fishing.

c. Probability that the proposed research will provide the facts necessary to restoration and scientific management of the fishery.

d. Special conditions of the investigation--needs for travel equipment and facilities.

Appropriate changes in the above points, based on the commercial fisheries, make them applicable as well to sport fishery projects.

All favor a periodic objective appraisal of research projects. These appraisals cannot possibly attain the exactitude implied by the term "cost accounting." The principles involved, nevertheless, should be the same. Results which may be measured in strictly monetary terms should not receive greater weight than fundamental contributions to knowledge.

Cost accounting contributes to self-appraisal, improved efficiency, and higher morale.

2. Personnel Problems. The consensus of opinion on grade and salary classifications is expressed in the following resolution.

RESOLUTION

WHEREAS, undoubted inequities exist between the grade classifications at the professional and subprofessional levels in the Division of Fishery Biology and other divisions of the Service and of other bureaus and agencies of the Federal Government, and

WHEREAS, this situation tends to lower professional standards of the Division and the professional standing of the individual research workers, and

WHEREAS, this situation further lowers morale, causes the loss of competent employees, and makes it difficult to attract the best qualified men,

NOW THEREFORE

BE IT RESOLVED, that immediate steps be taken within this Service and Division for the adoption and translation into positive action of the recommendations of the Advisory Committee on Scientific Personnel as approved in principle by the Civil Service Commission.

Efficiency ratings, to serve the purpose for which they are intended, should be prepared with greater care and more objectivity. Improvements in efficiency rating forms should be considered.

3. Field Office Routine. The consensus of opinion on field office routine is expressed in the following resolution:

RESOLUTION

WHEREAS, the lack of a brief, concise, clear and currently applicable reference on administrative routine constitutes a severe handicap in the administration of field offices and laboratories, NOW THEREFORE

BE IT RESOLVED that the following administrative guides be prepared and maintained on a strictly current basis, with appropriate references to original sources.

1. Listings of items of equipment and supplies classified according to procurement regulations and procedures applicable to each.

2. Statement of procedures applicable to open market, contract, and emergency expenditures.

3. A brief synopsis of principal administrative routines.

4. A concise statement of requirements and responsibilities for official travel.

5. Statements of changes in and additions to Service policy.

AND BE IT FURTHER RESOLVED, that no attempt be made to issue a divisional manual that would constitute nothing more than a second Field Manual of General Administration.

The report was adopted.

The Committee on Review of Divisional Programs presented the following resolution read by Dr. Rounsefell:

RESOLUTION

WHEREAS, organizations that are outside the Department of the Interior, like the Forest Service, Soil Conservation Service, international fishery commissions, and commercial fishing interests in Alaska, are securing appropriations for conducting fishery research, and are conducting fishery research, independently of the Fish and Wildlife Service; and

WHEREAS, offices within the Service other than the Division of Fishery Biology, such as the Office of Foreign Activities and the Office of River Basin Studies, are conducting fishery research independently of the Division of Fishery Biology; and

WHEREAS, it is contrary to the efficient and productive conduct of fishery research to have the direction of this work so loosely divided:

THEREFORE BE IT RESOLVED that this group here assembled deploras this tendency and urges the Director to explore some means of correcting this situation.

Committee for Review of Research Programs:

Dr. Rounsefell (chairman)
Dr. Galtsoff
Dr. Mottley
Miss Cable (recorder)

After discussion the resolution was unanimously adopted.

The committee appointed to report on Woods Hole, consisting of Dr. Rich, (chairman), Dr. Galtsoff and Dr. Walford, presented the following resolution read by Dr. Galtsoff:

RESOLUTION

WHEREAS the Woods Hole Laboratory of the Fish and Wildlife Service has in the past provided important facilities for fundamental research in the field of Fishery Biology, and has in its aquarium and exhibit room presented excellent possibilities for educating instructors of Biology and the general public in the aims and methods of conservation and the work of the Fish and Wildlife Service; and

WHEREAS this laboratory is now in such poor repair that this function cannot be adequately performed and the condition of the buildings and grounds is a discredit to the Service and the Department of the Interior; and

WHEREAS there is present and future need for such facilities to enable the research staffs of the Service to carry out scientific investigations where the exceptional advantages of the Marine Biological Laboratory, and the advice of the staffs and visiting biologists of these institutions may be had; and

WHEREAS the Woods Hole Laboratory can provide unusual opportunities for in-service training of the biologists in the Service;

THEREFORE BE IT RESOLVED that the Director be urged to restore the Woods Hole Station as an active center of Fish and Wildlife research.

The resolution was adopted unanimously.

A motion was made as follows:

That the Director be requested to bring together the Washington and Chicago offices of the Division of Fishery Biology as soon as possible.

The motion was seconded and adopted.

Dr. Galtsoff presented the following resolution:

RESOLUTION

The members of the Division of Fishery Biology here assembled wish to express profound thanks to the Director, Mr. Day; the Assistant Director, Dr. Cottam; and to the Chief of the Division, Mr. Elmer Higgins, for giving an opportunity to the field personnel of the Division to attend the conference, and to express their frank opinions regarding the important research and administrative problems.

We appreciate the democratic way in which the conference has been conducted and express our hope that the practice will be continued regularly, as a policy of the Service.

The resolution was seconded and adopted with enthusiasm.

Following brief comments by Mr. Higgins and Dr. Cottam, the conference adjourned at 3:15 p.m.

Texts of Addresses given during the conference are appended:

"Address of Welcome" by Director Albert M. Day ^{1/}

"Purpose of the Meeting" by Assistant Director Clarence Cottam ^{1/}

"Analysis of Research Program of the Division of Fishery Biology" by George A. Rounsefell, Assistant to Chief, Division of Fishery Biology

"Work of the Division of Fishery Biology" by Elmer Higgins, Chief, Division of Fishery Biology

The full text of the Great Lakes Program by Dr. John Van Oosten, and Dr. Ralph Hile, is also appended.

^{1/} Not available at time of issuance of this report.
Copies will be forwarded when available.

WORK OF THE DIVISION OF FISHERY BIOLOGY
(The Divisional Conference of 1947)
Elmer Higgins,
Chief, Division of Fishery Biology

It gives me great satisfaction to meet again with the leaders of fishery research in America.

This is the first meeting of the staff since 1929 which rates the designation of Divisional Conference. It is unfortunate that not all of the junior members of the staff can be present but, because of our size and the great cost involved, that may never again be possible as it was in the good old days.

Part of my satisfaction derives from my keen appreciation of the scientific accomplishments of the individual members of the staff. I find vicarious pleasure in your achievements for I feel that I have shared in them to some small degree. I also derive great satisfaction from the growth of the staff in numbers, in the widening scope of your collective competence and interests and in the evidence, to which these facts bear testimony, of the increased public appreciation of the Nation's aquatic resources and the need of scientific management for conservation.

In 1924, when I entered the service of the old Bureau of Fisheries there were 18 investigators employed on a full-time basis in the Division of Scientific Inquiry, the predecessor of this Division. The total appropriation for that year was \$91,000. When I came to Washington in 1927, there were about 25 investigators and the appropriation was \$144,000. Today there are 154 established permanent positions in the Division and the funds available from all sources total \$1,020,440. Thus, in the 20 years during which I have labored with you the scientific personnel and the funds for research have increased 7-fold.

Harking back to that last divisional conference of 1929, sixteen members of the staff then are still members of the Division. They include Miss Cable and Messrs. Chamberlain, Ellis, Galtsoff, Gutsell, Hildebrand, Holmes, Hopkins, Neville, Pearson, Prytherch, Rich, Rounsefell, Sette, Surber, and Van Oosten. M. C. James, H. J. Deason and Stillman Wright were also members of the staff who have other assignments at the present time. We have many other illustrious alumni who have left the Service, but we take especial pride in those who labor with us in other divisions and activities of our organization.

As I said before I take great satisfaction in the scientific accomplishments of our staff members in recent years. One of the chief values of this conference will be not a survey of what we have done and the scientific advances made, but an examination of what remains to be done and a critical appraisal of the conditions that will favor future achievement. I have no doubt that many of you have come to this conference with the expectation of seizing the opportunity to criticize and to air your grievances. I have no doubt that the succeeding sessions of this conference will be so searching and so frank in their appraisal of current conditions that hinder or favor successful research that any tendency to selfpraise or narcissism will be effectively scotched. Indeed, the program is designed for this very purpose. I believe, however, that it is worth while to take a few moments to review some of our accomplishments.

The Fish and Wildlife Service regulates and is responsible for the full utilization of the fisheries of Alaska. In the States it acts for the national interest as a research advisory and coordinating agency wherever several States have common conservation problems. It cooperates with other nations in the conservation of joint high-seas fisheries. The Division of Fishery Biology is the research arm of the Service for these important duties.

To conserve renewable resources like the fisheries continuing research is necessary. The rate of harvesting changes continually with economic conditions. The rate of replacement varies continually with changing natural conditions. The total stock of fishes available for capture, therefore, varies widely from year to year. The condition of the resource and its trends of abundance must be known and, if possible, foretold in advance if the billion dollar commercial fishery is to be conducted on a profitable basis. This great enterprise can be of permanent benefit to the Nation only if the natural supply of fishes is protected and if the forces of replacement and destruction are managed and balanced to assure continued productivity.

The productivity of the land has been increased many fold during the last century by agricultural research. The productivity of the waters may be increased proportionately by fishery research. But fishery science is new and, because fishes live in an element which man cannot enter, the methods of research are indirect, complicated and time-consuming.

Nevertheless, fishery science has made great advances in the past few decades. From a knowledge of the reproductive and growth rates of marine fishes we are learning how to secure the maximum production of highly nutritious protein foods without endangering the future supply. In some cases, through the application of "census" methods, we are able to predict the abundance of fish and relative success of future fishery operations which will promote the stabilization of the fishing industry.

In fresh waters we are learning how to propagate, transplant, restock and harvest food and game fishes with maximum benefits. We have learned how to fertilize ponds and lakes to increase fish production several fold over production from wild stock. We have observed the effects of deforestation, soil erosion and water pollution on the fish supply and have learned how to combat these conditions. We have studied the effects of engineering developments for irrigation, navigation, flood control and generation of power on our fresh water fishes and on fishes that come from the sea to spawn in our rivers, and we are developing methods of utilizing impounded waters for fish production and of overcoming the adverse effects of dams.

We are developing practices and systems of fishery management which assure conservation of the supply yet permit full utilization. Success in these undertakings and continued improvement in the cultivation and management of this valuable resource demands eternal vigilance, continued research and (may I add) increased appropriations.

Let us examine in a little greater detail a few of the more tangible and dramatic accomplishments of our research staff of benefit to the commercial fisheries, to the shellfisheries and to the fisheries in the inland waters.

Investigations concerning the management and conservation of the commercial fisheries.

The billion dollar commercial food fisheries of the United States range from the high seas off Nova Scotia, along the Atlantic Coast, in the Gulf of Mexico, in the Pacific from the equator to the Bering Sea, in the Great Lakes, and in our principal inland rivers. The industry needs scientific guidance for the fish supplies in some of this vast territory may be unutilized and hence wasted or they may be over-exploited, at best producing less food at greater cost and at worst the basic stock may be endangered.

The Department of the Interior, through the Fish and Wildlife Service, is required to manage directly the valuable fisheries of Alaska. This is a \$65,000,000 responsibility. If properly managed, the resource will produce at this level in perpetuity and it may be materially increased.

With a coastline seven times as great as that of the continental United States, fishery research, which must blueprint fishery management year by year, is conducted with inadequate funds and personnel under unusually difficult conditions, yet real achievements have been made. Predictions of the annual runs of salmon in the various districts are made regularly with fair success as a basis for regulations. A decline in production of red salmon in western Alaska led to the protection of the runs in the poorest cycle (1940 and 1945) so that production in 1950 promises to be the best of this cycle since 1920.

Research has revealed the cause of the continuing decline since 1921 of the red salmon fishery of the Karluk River on Kodiak Island as the depletion of food supply in the lake. There is ample reason to believe that the perfection of methods to overcome this deficiency can increase salmon production by a minimum of 25 percent which means an annual increase of \$375,000 in the value of Karluk-produced canned salmon.

Annual censuses of the herring populations in Alaska which produced \$6,500,000 worth of products last year, have revealed the causes of wide fluctuations in yield. Based on these studies, a catch-quota system of management has been applied with increased stabilization of the industry. The Southeastern Alaskan herring fishery reached its peak development in 1929, producing 135 million pounds of fish. Overfishing resulted in a decline in yield in 1939 to only 29 percent of the maximum production. On the advice of our biologists the fishery was then closed completely. Within three years the stock had recovered sufficiently to permit limited fishing with the result that the yield in 1946 exceeded 80,000,000 pounds, worth more than \$2,000,000. Conservation pays.

There are still unexploited fishery resources in the Gulf of Alaska, awaiting only exploration and development. The location and removal, under scientific direction, of barriers to salmon migration in Alaskan rivers, begun last summer, promises to increase the total suitable spawning area by 4 percent and add \$2,000,000 annually to the industry.

This year's catch of sardines or pilchards on the Pacific Coast which normally amounts to more than a billion pounds, (one-fourth of the total fishery harvest of the United States) is only half as great as last year's catch. Some declare this is the result of many years of overfishing, but ten years of scientific investigation on pilchard stocks indicate that this crisis probably is due to natural causes. The industry faces the hazard of having more severe restrictions imposed, either by State regulations or by curtailment of credit or both, when in fact, restriction may be needless. While much has been learned regarding subnormal reproduction of pilchards in recent past spawning seasons, an investigation of sea temperatures, salinities, nutrients, and food supply in relation to ocean currents and in relation to distribution of the fish, would enable us to separate natural factors from the effects of fishing and provide insurance against mismanagement. Real progress has been made in understanding the natural economy of the sardine supply but investigations should be continued and extended to offshore waters to perfect the management of this great resource.

The centuries-old New England fishery has reached an all-time peak of productivity and today ranks among the top two or three of the Nation's food fisheries. Fishing is currently providing over 15,000 fishermen with more than \$40,000,000 per year and supporting large associated industries.

Research indicates that the present downward trend of the \$10,000,000 haddock fishery is caused by a reduced spawning stock and other effects of an intensive fishery. The greatest annual production in this fishery could be obtained by maintaining the adult stock at a level about double that of 1930. This could be accomplished by use of savings gear, developed during research work at sea, which would reduce the destruction of under-sized haddock by about 80 percent and by adoption of a minimum size of two pounds. The alarming decline in New England haddock stocks after a limited improvement during 1940 and 1943, was caused by very poor survival of young haddock produced in 1941, 1942, and 1943. There are indications that this poor survival of young haddock was caused by a decrease in fish food on the trawling grounds to a level much below that which existed in 1920 to 1930. The impending crisis in the haddock fishery will demand aggressive action. Past research and continued studies will show the way.

The blue crab of Chesapeake Bay exhibits wide variations in abundance that cause large losses to the industry. Restrictions on the catching of adult egg-bearing crabs did not remedy this condition. Research has just discovered that these variations in abundance are caused by changes in the survival of young crabs rather than by the number of eggs spawned. This survival is influenced chiefly by stream flow, especially in the James River, there is a very promising prospect that further studies of the manner in which crab survival is influenced by these flows may make it possible to raise the average abundance of crabs in the Chesapeake Bay through regulating stream flows by means of flood control and power dams now proposed by the Corps of Engineers. The reimposing of restrictions on the catching of egg-bearing crabs which was popularly advocated would have cost the fishermen nearly a million dollars a year without increasing the supply of crabs.

Development of methods for the culture and management of the shellfishery resources.

The shellfisheries of the U. S. produce 412 million pounds of food, worth 34 million dollars to the producer. The most valuable seafood crop of the Atlantic States is oysters, producing in an average year, 89.9 million pounds of meat, equivalent to the edible portion of 160,360 beef cattle. Fifty-eight percent of this production comes from cultivated oyster farms and the remainder from the wild stock on public beds.

The Division's oyster investigations have provided knowledge of great practical benefit to the oyster industry. In Chesapeake Bay they have provided information on the time and locality for planting oyster shells to obtain a maximum production of seed and market oysters. In the lower Bay they have provided the information on pollution conditions which permitted the reopening of about 80 percent of valuable oyster beds which were closed to fishing during the war because of the great temporary increase in population in the area.

The Service recommended that the State of Maryland open certain areas in the upper Chesapeake Bay to oyster dredging. This action was responsible for an additional production of about 350,000 bushels of oysters, valued at \$250,000 which otherwise would have been lost because of freshets from the Susquehanna River. In 1945 about 1,400,000 bushels of oysters, valued at \$2,500,000 were lost from this cause.

The State accepted the Service's recommendation that shell planting be confined to the middle section of the bay where there is less danger of freshets. Formerly seed production in the upper bay was very uncertain. Seed producing areas, however, have been established in three other areas where upwards of one million bushels of young oysters can be produced. Adoption of the Service's recommendation resulted in the production of 700,000 bushels of seed oysters, valued at \$1.00 per bushel during 1946.

In other sections of the south, the Division has studied the effects of crude oil, pulp mill waste, and other pollutants on oysters. Adoption of recommendations for correction have led to direct material gains to the oyster men in recovery of their losses caused by pollution and in the conservation of a large acreage of ground for the production of seafood.

Studies of purification of shellfish by chlorination now make possible more efficient and economic practices in chlorination plants operated in New York, Massachusetts, and other States.

Oyster farming is most widely practiced and has reached the highest development in southern New England waters. In Long Island Sound alone, over a million bushels of shells are planted annually to serve as "cultch" for the collection of seed oysters. Formerly, successful seed-oyster production occurred quite irregularly at intervals of several years. Research on the biology of oyster spawning and development of oyster larvae and seed and advice to the industry on improvement in methods have brought about no failures of seed production, and good to excellent results every year.

Bulletins to the oyster industry, prepared and distributed at about 10-day intervals throughout the summer season, have been issued during the past 10 years. These bulletins present information and predictions on the time and intensity of oyster spawning and setting in various sections of Long Island Sound, on the survival and growth of recently set oysters, the best periods for transplanting oysters, unusual mortality among oysters, abundance and distribution of oyster enemies and methods for their control and on many other practical subjects. The information is gathered by the persistent year-round studies and observations of our biologists. A score or more of unsolicited letters of praise and endorsement of these services have been received from the oyster industry.

Advice has been freely issued regarding oyster and clam planting practices to individual shellfish farmers, companies and State officials. In more than 50 percent of the instances in which government help was asked, proposed planting programs submitted to the Service were found to be defective or impractical and doubtless would have resulted in heavy financial losses. During the past year, a very large percentage of requests for this type of information was received from war veterans desiring to enter the shellfish industries.

Studies of water quality, pollution, and other problems in relation to fish cultural practices and techniques and the management of sport-fishing waters.

The management of our inland fisheries is of concern to over 14 million anglers. The Service conducts research on improvements of fish cultural techniques to increase production or promote economy in propagating fishes for stocking depleted or barren waters, on the management of these waters in order to support satisfactory angling and on the suitability of waters to support fish life either in their natural condition or when polluted by domestic and trade wastes. The application of research findings, therefore, are of nation-wide scope.

A great deal of information has been secured on the effectiveness of closed seasons and size limits, the kinds and numbers of hatchery fish for stocking streams and other management methods. In certain New England streams, set aside as test waters, the success of various methods was determined by an accurate "creel census" which measured the result from the fishermen's standpoint. In the southern Appalachians similar studies using the same methods revealed that stocking streams with hatchery fish in the spring months produced five times as much in the angler's catch as would have been produced by fall stocking which heretofore has been widely practiced.

Investigations of damage to fish and wildlife caused by invasion of the water hyacinth in southern waters have revealed that the losses run into millions of dollars. Vast acreages of otherwise productive waters have been made barren by the invasion of this plant pest, and methods of control are being developed with the Corps of Engineers and other Federal and State agencies.

During the war DDT came into widespread use for the control of insect pests. Heavy applications of DDT to forest areas and swamp lands carried the threat of severe losses to the fish supply. Investigations have developed formulae and rates of application which are not harmful to fish.

Since 1870 fish hatcheries have been regarded as the chief means of maintaining fish supplies in the United States. Serious losses, reduced efficiency, and increased costs have been caused by fish diseases in the hatchery. When crowded together fish may have cancer, goiter, anemia, and malnutrition, and may be infected by bacteria and parasitized by protozoa and worms. One of the most dreaded fish diseases, furunculosis, has caused widespread losses in streams and hatcheries in Europe and America for a century. Although intensively studied in Europe for 25 years, no effective control had been found until last year Service biologists discovered that one of the sulfa drugs, sulfamerazene, was effective in curing the infection. The treatment is now being standardized and will result in the saving of hundreds of thousands of dollars in the Nation's five-hundred-odd hatcheries.

The largest item of expense in operating hatcheries is the annual food bill. With the scarcity and rising costs of liver and other meat products, a diligent search has been made for substitute food products. This has led to an investigation of the fundamental dietary or nutritional requirements of hatchery fish. The principal food requirements, carbohydrates, proteins, minerals and vitamins, have now been largely determined and basic diets producing rapid growth, high vigor, and maximum survival have been devised with the result that costs of production have already been greatly reduced in the Federal hatcheries.

The propagation of warm water fishes, particularly in farm ponds has undergone marked improvement in efficiency as the result of scientific investigations. Farming the water is similar to but more intricate than the farming of land. Methods for fertilizing water areas to increase basic fish food production, using both organic and inorganic fertilizers, have resulted in an increase in fish production running 100 to 300 percent over production in unfertilized areas.

Methods of weed control, a serious problem in water farming, have been developed using various substances not harmful to fish, such as copper sulphate, sodium arsenite, and the new weed killer (2, 4-D) developed during the war.

In the west, investigations in recent years have been directed chiefly to improving the artificial propagation of salmon and to their protection from irrigation and power projects. Extensive hatchery operations are conducted throughout the Columbia River Basin where disease and food problems are encountered as their result. An effective method of treating external parasites and bacterial diseases of salmon has been developed, permitting treatment of whole rearing ponds full of fish instead of individual fish, with corresponding economy in labor and safety from fish mortalities. Formalin, Roccal and other antiseptic agents have been found to be effective when used in proper dilution, properly distributed and for proper periods.

Pollution of our waters has become a National disgrace. The Service has no regulatory authority, but advises the States and private industry on methods for pollution abatement.

The Division has just completed a much-needed manual of methods for use by technicians in determining the gases and dissolved and suspended chemicals and materials in water so that the quantities of these substances can be determined in testing water for its effect on fish life.

A recent survey has shown clearly that the decline of the shad runs in the Delaware River from 17,000,000 to about 100,000 pounds per year is due to the water being robbed of its life-sustaining oxygen by severe pollution.

The foregoing is but a selected sample of the solid accomplishments of the Division during the past few years. There are certainly many more which have been omitted but which are equally worthy of recording. Much of the foregoing was prepared for the use of the Congress in considering appropriations for the coming fiscal year; therefore, results to which a dollar sign could be attached in some way were chosen.

I have not touched upon nor shall I now take the time to mention contributions to science which have been made by many of you; contributions in techniques, in research procedure, in the development of basic concepts and, in some cases, even the formulation of broad hypotheses of fundamental principles. Fifty years from now these less tangible contributions may far outweigh those which I have listed, even when measured by economic standards. They are, however, for the most part hidden and perhaps unappreciated. At the present time they are of the greatest interest to science itself, but their values can only be guessed.

This account is a record of real achievement, but it is not enough. We must not rest on our laurels, green as they may be, for we have several years of wasted effort, losses as real as all the other tragic losses of war, for which compensation must be made.

In the Research Program of the Division for 1947, issued last September, I stated that our post-war plans included first the bringing up to date, the completion and the full reporting of results of major lines of investigation which have been under way for sometime and which show the greatest promise of scientific achievement and practical application. This objective comes before the other objectives of expanding existing fishery investigations, undertaking new problems arising in the post-war years, or attempting to expand or more fully utilize the basic fishery resources.

I know that many of you are bending all your energies toward this particular end. It is not always wise to drop completely existing projects for the sake of concentrating on the preparation of reports for those that are nearly completed. Nevertheless, the remainder of this fiscal year and the next present a unique opportunity to publish the results of your investigation. For the first time in history there is more than ample money for publication; indeed, the editor is virtually hounding me for manuscripts to print. Publication is probably the most direct, the most immediate, and the most tangible result of the great mass of scientific research.

There have been criticisms to the effect that the research work of the Service in recent years has lost standing in the scientific world. If this was true in the past it can be blamed in large part on a shortage of funds for publication. If it is true in the future the blame must be placed elsewhere. I say this with some confidence because the system of appropriations has changed. No longer is the Service compelled to beg for hand-outs from the Departmental appropriations for printing, but estimates are submitted, defended, and the funds are now appropriated directly to the Fish and Wildlife Service. Moreover, they have increased this year and a moderate increase is also contained in the budget for next year.

The remaining sessions of this conference will bring out clearly and unequivocally other conditions which tend to hamper research in fishery biology. With this array of talent I have no doubt that solutions for many of the difficulties will be found, and I can assure you that they will be applied if means of correction are found in the Service. Plans are already made for some adjustments in the basic organization of this Division which will improve conditions for research. I shall discuss alternate plans with you later. They have been held in abeyance until the benefit of your collective advice could be secured.

I am confident of the future. I am proud of this organization. I am impressed by our opportunities for constructive work, and I am overwhelmed by our responsibilities in fulfilling the trust which the Service, the Department, and the Nation place in us.

ANALYSIS OF RESEARCH PROGRAM
of the
Division of Fishery Biology

George A. Rounsefell
Assistant to Chief, Division of Fishery Biology

As chairman of the Technical Planning and Coordination Committee there has been placed upon me the duty of analyzing our research program. This analysis has been based wholly on data that are vital in building an effective program. I was rather surprised at the implications of these data, but knowing that you are all eager to discover possible weaknesses in our program, I am going to lay the report on the block.

I feel that I occupy a unique position. After 20 years of field work on both coasts and Alaska, I am well acquainted with the field viewpoint. Washington was always a place that returned your expense vouchers, cut your allotment on the first of July, and asked for reports that did not appear to serve any useful purpose. The past two and a half years in Washington have convinced me that the field judgment was a trifle harsh. People in Washington work hard too, and often under great pressure. Deadlines are only too common. However, it is one thing to meet a deadline without interruption and quite another to concentrate on a subject with a host of major and minor crises demanding immediate action.

Perhaps the field and the Central office cannot always be in complete accord, but when a problem is approached with a sincere desire for an effective solution, then differences in viewpoint may be healthy and stimulating.

Coming at the end of the program, this section will not need to touch upon the many phases in the building of a research program that have been thoroughly discussed in the past two and a half days. You have already defined "research", outlined fields of research which we should be engaged in, and discussed the methods for determining the priority of a research project.

If I may be allowed a bit of humor, we research personnel have regarded ourselves as high priests of a sacred cult dispensing wisdom to the plebeian multitude. There is an ancient convention that research must be unhampered, unfettered—the pattern is to whisper the name of the subject to be pursued to the candidate, who then goes forth and in his own mysterious ways finds out something about the project. It may be what you want to know or it may be something he wants to know or it may be something that somebody else wants to know. The chance that it will answer a question of significance in guiding the management of a fishery is almost wholly fortuitous and coincidental. If the candidate forms any theories in his lifetime he may be tempted or goaded into writing a report. With roomfuls of filing cases about him he retires into seclusion and finally emerges with the great masterpiece. After wading through reams of partially digested field notes, published to put them on record, and failing to find any conclusions not hedged about with "ifs" and "maybe's" the tired administrator puts the tome back on the shelf and continues to make empirical decisions wishing, meanwhile, that he were bright enough to interpret the report.

Judging, however, by the volume of completed reports received in 1946 5 reports from 201 subprojects, there are only seven chances out of eight that any particular subproject will be completed during the usual 35 years of government service allotted to one individual.

You cannot build a research program merely by hiring anyone with a college degree who has taken comparative anatomy and made sketches of Paramecia. Unless the man has more quantitative biological training than that ordinarily given, he is not qualified to commence work immediately in most fields of fishery biology.

I see that some of you think that perhaps a man should be entirely unhampered, but wait--let me show you the results of allowing research to wander - - -

I have listed, recently, the personnel in the Division. It changes from day to day so that, while the tabulation can never be up to date, it does represent an average. The Division had 200 permanent employees, and 21 temporaries. Of the 200 permanent employees, there were 102 professional ratings, 43 with subprofessional, 42 with CAF, and 13 with CPC, chiefly caretakers, etc. around our laboratories.

With a total Divisional roster of 102 professional employees, the Division in 1947 has been engaged in a program with 201 subprojects. Rather an amazing total when you think of it, a half of an investigator per subproject. Either our subprojects are too finely defined, or we are spread too thin. I find that 25 of our projects, over 12 percent, are in reality merely applications of research, and thus may not be really research projects at all. Delving further into these projects, I have made a classification which is admittedly not purely objective and based somewhat on my personal view of the subject matter and the urgency of each project.

I have classified the priority of these subprojects under 5 headings: "urgent" being those upon which we must concentrate because of a dangerous situation in the fishery, because of the great value of the fishery and the increased values that may be expected to accrue to the fishery through the solving of the subproject, or because management of the fishery is the responsibility of the Service. "Essential" subprojects differ from "urgent" chiefly in the necessity for an immediate answer or in the lesser value of the solution. "Desirable" subprojects are ones upon which we should engage if our facilities warrant, but which can be dropped if necessary. "Optional" subprojects can be dropped without impairing the purpose of the Division. "Unnecessary" subprojects are those that should be eliminated. My classification shows that in 1947, out of our 176 purely research projects, 35 were urgent, 75 were essential, 56 were merely desirable, 7 were optional, and 3 were unnecessary.

If I am correct in assuming that we are spread too thin, then it would appear that this committee is entirely justified in asking each section chief to scrutinize closely the priority of each subproject submitted for 1948. I believe the committee is also justified in recommending the abandonment, through discontinuance or preparation of a terminal report, of the 10 unnecessary and optional subprojects, and the scaling down of operations on subprojects that are merely desirable.

Another question comes to mind in connection with the development of our research program, and that is the work load in relation to the available staff within each section. Analysis shows either that some sections are attempting more than can be accomplished with their available staffs, or that their staffs are more efficient than those of other sections. Which is true, I am not attempting to explain.

In order to have a purely objective rating as to the staff available to each section, I have employed a weighting device in which I have weighted each grade of employee according to a predetermined scale. The same device has been employed with the subprojects giving a weight of 4 to the urgent, 3 to the essential, and 2 to the desirable subprojects. I have shown the weighted personnel available per weighted subproject for each field unit (Table 1).

Table 1 clearly shows a great disparity between the work load and available personnel. I have also shown what personnel shifts would be needed to correct this disparity. Personnel appears to be most needed in the Gulf of Mexico, North Atlantic, Alaska, and Eastern Inland Sections, whereas there appears to be an over-abundance of personnel in relation to the importance of the program in the North Pacific, South Pacific, Southwestern Inland, and Water Quality Sections. I am ignoring the Ichthyological Laboratory and the Beaufort Laboratory which have staffs too small to make shifts in personnel practicable.

This analysis has been made, as I have stated, on the basis of the 1947 program. It is possible that the 1948 program to be discussed will in itself take care of many of the existing inequalities between personnel and work load, but where the inequality is outstanding it is possible that action is called for either in the form of increasing or decreasing the work load or shifting personnel.

I do not believe that the average is necessarily the ideal. Perhaps those sections with the most personnel for the work load come closest to what is needed for effective work. If this be true, perhaps a combination of a scaling down of subprojects with a low priority together with some personnel shifts is the correct answer.

The inauguration of new projects is closely connected with the closing of old projects for no one believes that indefinite expansion is either likely or desirable. The Division often undertakes new work. What, then, happens to the old? Logically a subproject should end in a terminal report, but this is patently impossible at the present tempo of report writing.

Table 2 shows by years the reports promised for the various subprojects. The 71 subprojects with no definite termination date have been divided between 7 years and are shown on dotted lines. If one accepts the promised dates for reports at their face value the conclusions are startling. The 105 definite promises are strung out over a period of ten years. What are the chances of obtaining these 105 reports on the dates due? Judging from the experience during 1946 we can expect about 20 percent of them, or 21 reports. However, the accumulated reports not completed on schedule will cause more and more delay so that it is impossible to predict the rate of completion.

Research Subprojects
Operational Subprojects

Weighted Urgent 4
Essential 3
Desirable 2

PERSONNEL

Personnel Needs
1947
Program

Section	Urgent	Essential	Desirable	Urgent	Essential	Research	Operational	Total	P-4 and 5	P-3 and 2	P-1 and SP-6 to 7	SP-2 to 5	Total Numbers	Weighted Personnel	CAF and CPC	Total Weighted Personnel	Personnel	Points
									4	3	2	1						
Alaska - - - - -	8	12	7	1	3	68	13	81	2	8	3	5	18	43	5	48	27	1
North Pacific - - - - -	2	10	7	2	-	38	8	46	4	9	7	5	25	62	9	71	-	28
South Pacific - - - - -	-	5	7	-	-	15	-	15	3	3	1	1	8	24	3	27	-	13
Gulf of Mexico - - - - -	1	6	2	-	-	22	-	22	1	1	-	-	2	7	2	9	11	1
Middle Atlantic - - - - -	3	3	3	-	-	21	-	21	1	3	1	2	7	17	3	20	-	1
North Atlantic - - - - -	8	17	9	-	-	83	-	83	1	6	3	4	14	32	8	40	37	1
Great Lakes - - - - -	1	1	4	-	1	7	3	10	1	2	-	-	3	10	2	12	-	3
Eastern Inland - - - - -	6	3	2	-	1	37	3	40	3	3	-	1	7	22	3	25	12	1
Southwest Inland - - - - -	-	3	-	4	1	9	19	28	1	6	6	4	17	38	2	40	-	14
Western Fish Culture - - - - -	2	4	1	-	3	20	9	29	1	3	3	2	9	21	1	22	5	1
Shellfish - - - - -	3	8	7	-	4	36	16	52	4	4	4	7	19	43	10	53	-	5
Water Quality - - - - -	1	1	2	-	-	7	-	7	2	3	1	5	11	24	1	25	-	18
Ichthyology - - - - -	-	1	5	-	-	3	-	3	1	1	-	1	3	8	0	8	-	5
Beaufort - - - - -	-	1	-	-	-	3	-	3	1	-	1	1	3	7	3	10	-	7
Totals - - - - -	35	75	56	7	13	369	71	440	26	52	30	38	146	358	52	410	92	93

TABLE I

TABLE II

Analysis of Terminal Stages of Subprojects

Section	Years reports are due										Without terminal stage			Reports in arrears
	46	47	48	49	50	51	52	53	56	Indef- inite	Annual	Continuous		
Alaska - - -		1			3					15	11			
N.Pacific- -			4	1	4			3	5			6		
S.Pacific- -		6								5	1			
Gulf of Mex.		7		1						1				
M.Atlantic -	7	3	1							4			7	
N.Atlantic -	13	8	1	1						15	6		12	
Great Lakes-	1	3								2	1		1	
E. Inland- -	1	3	1							1		7		
SW. Inland -			1	1	1	2				2		2		
W.Fish-Cult.			2	3			3			3	2			
Shellfish- -	3	4	1							17		1	1	
Water Qual.-	1											5		
Ichthyol.- -		2	1	1	1					4				
Beaufort - -										2				
Totals	26	37	12	7	10	2	3	3	5	71	21	21	21	
												113		
Cumulative Totals	26	63	75	82	92	94	97	100	105			218		

Operational Projects
(Fishery Biology in advisory capacity only)

Alaska	1.6	Alaska Fishery Statistics ¹
	1.7	Improvement and Expansion of Salmon Spawning Areas ²
North Pacific	2.31	Design of Fishways and Screens ³
	2.32	Operation of Fish Screens ⁴
	2.61	Grand Coulee Fish Maintenance Program ⁴
Great Lakes	7.22	Collection and Analysis of Catch Data ¹
Eastern Inland	8.8	General Diagnostic Service ⁴
S.W. Inland	9.2	Effect on Fisheries of Central Valley Water-Use Project ³
	9.3	Salmon Salvage in Connection with Shasta Dam ⁴
	9.4	Miscellaneous Surveys to Determine Effects of Water-Use Projects ³
West. Fish. Cult.	10.21	Biological Control and Diets at Grand Coulee Hatcheries ⁴
	10.22	Biological Control and Diets at Shasta Dam Hatcheries ⁴
	10.23	Development of Frozen Prepared Diets ⁴
	10.25	Fish-cultural Methods ⁴
	10.42	Potential Hatchery Sites ⁴
	10.43	Hatchery Design ⁴
Shellfish	11.12	Setting of Oysters in Long Island Sound (industry aid)
	11.18	Setting of Oysters in Chesapeake Bay (management)
	11.31	Controlled Management of Public Oyster Bars
	11.41	Control of Starfish and Drills
	11.53	Pollution of Oysters in Hampton Roads Area ⁵

1 Responsibility of Division of Commercial Fisheries

2 Responsibility of Alaska Division

3 Responsibility of River Basin Studies

4 Responsibility of Division of Gamefish and Hatcheries

5 Responsibility of State and Federal Public Health Services

Unnecessary Projects

N. Pacific	2.62	Spawning of Salmon and Trout in Upper Columbia and Snake
Ichthyology	13.15	Revision of the Family Gobiidae
	13.16	Revision of the Family Eleotridae

Optional Projects

Middle Atlantic	5.22	Life History of Fluke
	5.24	Abundance of Sea Bass
North Atlantic	6.61	History of the Rosefish Fishery
	6.72	Distribution of Fish under Price Ceilings
Water Quality	12.3	Effects of Water Leaching Rock Masses
Ichthyology	13.14	Taxonomy and Distribution of Menhaden
Beaufort	14.2	Terrapin Culture

Analysis of Priorities of Subprojects for 1947 Research Program

	Research subprojects					Operational subprojects		
	urgent	essen- tial	desir- able	option- al	unneces- sary	urgent	essen- tial	desir- able
Alaska	8	12	7			1	3	
North Pacific	2	10	7		1	2		1
South Pacific		5	7					
Gulf of Mexico	1	6	2					
Middle Atlantic	3	3	3	2				
North Atlantic	8	17	9	2				
Great Lakes	1	1	4				1	
Eastern Inland	6	3	2				1	
Southwest Inland		3				4	1	
W. Fish-culture	2	4	1				3	3
Shellfish	3	8	7				4	1
Water Quality	1	1	2	1				
Ichthyology		1	5	1	2			
Beaufort		1		1				
Totals	35	75	56	7	3	7	13	5

State of Subprojects¹

Section	A	B	C	D	E	F	G	
Alaska - - - - -		6	4	-	13	1	7	31
North Pacific- - - -		3	3	1	12	1	4	23
South Pacific- - - -		1	2	3	6	-	-	12
Gulf of Mexico - - -		1	-	-	6	-	2	9
Middle Atlantic- - -		6	1		3	1		11
North Atlantic- - -	5	4	2	1	21		3	36
Great Lakes- - - - -		4	1		2			7
Eastern Inland - - -	1	3		1	5	1	1	12
SW Inland- - - - -		1			2		5	8
Western Fish-Cult. -		1			2		10	13
Shellfish - - - - -	3	7	1		7		5	23
Water Quality - - -	1	1	1				2	5
Ichthyological Lab.	1		8					9
Beaufort Lab. - - -							2	2
Totals	11	38	23	6	79	3	41	201

1 A = Exploratory

- B = Preliminary investigation
- C = Data Collecting and Inventory
- D = Methods of research
- E = Investigational
- F = Experimental
- G = Observational and management

PROGRAM FOR INVESTIGATION OF THE GREAT LAKES FISHERIES

John Van Oosten and Ralph Hile

Organization, Personnel, and Equipment

The anticipated Great Lakes treaty demands an expansion of our research facilities including the establishment of several field stations. At least six points must be considered in framing our research program, in setting up facilities, and in allotting appropriations.

1. Although Ann Arbor, Michigan, is centrally located in the Great Lakes region, distances to various sections are nevertheless great, and travel must necessarily be extensive. For example, the road distance from Ann Arbor to Warroad, Minnesota, is 1,023 miles; from Ann Arbor to the Canadian border in New York it is 564 miles--a total of 1,587 miles between the two extremes. This is equivalent to the greatest north-south U. S. dimension from the Canadian to the Mexican border.

2. The Great Lakes shoreline in the U.S. exclusive of the islands is recorded as being 3,774 miles long. (It will exceed 5,000 miles if the islands are included.) This shoreline may be compared with the detailed U.S. coast line (shores subject to action of open sea; excludes coasts of bays and rivers) of other areas; Atlantic 2,304; Gulf 2,028; Pacific 1,577--grand total 5,909 miles.

3. Commercial fisheries are scattered along the greatest part of the more than 5,000-mile shoreline including the islands; any cove, bay, or stream that affords protection may harbor one or more commercial fisherman. There were 5,100 fishermen, 500 vessels, and 1,800 boats engaged in the fishing industry in 1940 on the Great Lakes.

4. The Great Lakes are the principal or only source of high-quality fresh-water fishes in the U. S. produced for the market. The high quality is reflected in the average prices paid the fishermen. In no other area of the country are these prices as high as in the Great Lakes region. For example, in 1943 and 1944 the average prices for all Great Lakes species were 15.6 and 14.5 cents a pound respectively. (Michigan's average price in 1945 was 21.4 cents.) Corresponding values for the Pacific coast states and Alaska are 3.6 and 3.5 cents, for the Atlantic coast 3.7 and 3.2 cents, and for the entire country 4.9 and 4.6 cents.

In allotting appropriations the values as well as the quantity of fish must be considered in addition to other factors. The Great Lakes yields in 1943-1944 equaled 16 and 18 percent of all salmon taken in the U.S. and Alaska, but the corresponding values equaled 58 and 61 percent (average price of salmon was 4.2 cents). Again, the Great Lakes take in 1943 and 1944 equaled 24 and 21 percent of the landings at Boston, Gloucester, and Portland, but values equaled 55 and 54 percent. Examples could be multiplied to show that the Great Lakes fisheries rank very high in value (11,500,000) as

compared with those of other regions, although the yields may be relatively small (75,000,000 pounds).

5. Sport fisheries as well as the commercial fisheries are covered by the treaty. Some species of fish are taken both for sport and for the market. Hundreds of thousands of anglers fish the Great Lakes each year, and their catch must run into millions of pounds. The Great Lakes are located in heavily populated areas. Approximately 13,795,000 people or more than 10 percent of the U. S. population live in the counties that border the Great Lakes, and have a direct interest in these lakes. (52,798,000 persons or 40.1 percent of the U. S. population live in the eight Great Lakes States.)

6. A dozen important species or groups of fishes (chubs, whitefish, lake trout, herring, walleyes, blues, saugers, perch, sheepshead, white bass, smelt, suckers) as well as certain predators (sea lamprey, burbot) need study. Those fishes which occur in more than one lake need investigation in each lake separately, as for example, whitefish, walleye, and perch. Even in the same lake a species may comprise more than one population each with different habits, etc., as, for example, lake trout in Lake Michigan. The number of separate stocks that need investigation may run into a hundred or more. A small staff cannot do this job adequately.

Field Stations: How do we propose to handle the complex and difficult situation on the Great Lakes? We believe that it is absolutely essential to establish at least four field stations in addition to the central office at Ann Arbor. We suggest the following locations: Bayfield, Wisconsin; Sheboygan, Wisconsin; Charlevoix, Michigan; Rochester, New York.

1. The Bayfield station could cover the Lake Superior shores of Minnesota, Wisconsin, and Michigan east to but not including Marquette (includes Isle Royale). Bayfield is 693 miles from Ann Arbor. The principal species to be investigated are herring, trout, and whitefish. Wisconsin may be able to furnish quarters either at the hatchery (2 miles from Bayfield) or at the state building in the village.

2. The Sheboygan station could cover the Lake Michigan shores of Illinois, Wisconsin, and Michigan east to and including the Garden Peninsula. Sheboygan is 383 miles from Ann Arbor. The principal species to be investigated are trout, chubs, whitefish (Door County), herring, perch and smelt (Green Bay). Wisconsin may be able to furnish quarters in its building at Sheboygan.

3. The Charlevoix station could cover the Lake Superior shore from Marquette and east, the St. Marys River, the Lake Huron shore south to Greenbush, and the Lake Michigan shore from Manistique to Pentwater, Michigan. Charlevoix is 266 miles from Ann Arbor. The principal species to be investigated are trout, whitefish, chubs, herring, and suckers. The U. S. Fish Hatchery may be able to supply office and storage facilities.

4. The Ann Arbor office could cover the Lake Michigan shores of Indiana and Michigan north to but not including Pentwater, the Lake Huron shore from Greenbush and south, the connecting waters between Lake Huron and Lake Erie, and the Lake Erie shores of Michigan and Ohio. The principal species to be investigated are trout, chubs, herring, whitefish, walleyes, perch, blue pike, sheepshead, white bass, and black bass. The University of Michigan already furnishes us accommodations.

5. The Rochester station could cover the Lake Erie shores of Pennsylvania and New York, the Niagara River, Lake Ontario, and the St. Lawrence River. Rochester is 427 miles from Ann Arbor. The principal species to be investigated are blue pike, herring, chubs, whitefish, trout and black bass. The University of Rochester may be able to furnish quarters.

The alternatives to the above division of labor on a regional basis would be a division based on the individual lakes or on the individual species or fisheries of a lake or all lakes such as the lake trout. These alternatives, however, would involve more time and expense in travel (as well as duplication of travel) and would not provide the opportunity for us to become thoroughly familiar with the local problems or be kept informed on them. Under the regional setup an investigator can still concentrate on a particular species if this proves desirable and obtain assistance from the different field offices.

Duties: The Ann Arbor office would be responsible for the program in its own assigned area and for the over-all planning, coordination, and supervision of the research program of the four stations. It would also handle the fiscal and personnel matters of these stations. Each station would be responsible for the program in its territory; collect, compile, and analyze data; prepare progress and final reports; collect statistics as required; keep in touch with local problems and questions.

Research Problems

What we face in organizing a research program on the Great Lakes can be understood if we give first an idea of the actual numbers of individual stocks of fish that possibly might require investigations. Let us begin with a listing of the principal species and the number of lakes in which each is produced in sufficiently great quantity for it to be termed "commercially important."

<u>Species</u>	<u>No. of Lakes</u>	<u>Comments</u>
Lake trout	4	All but Erie
Lake herring	5
Whitefish	5
Chubs	22	Several species (up to 7) in each lake but Erie
Walleye	5	Including Lake St. Clair, excluding Superior
Blue pike	2	Erie, Ontario
Sauger	1	Erie
Yellow perch	5	Including Lake St. Clair, excluding Superior
Suckers	4	All but Superior
Burbot	2	Michigan, Erie
Carp	4	All but Superior
Sheepshead	1	Erie
Catfish	4	All but Superior
Smelt	5
White bass	1	Erie
	<u>70</u>	43

These entries add up to the not inconsiderable total of 70 species-lake combinations--and the story does not end here. Since each lake contains varied types of waters, it may be considered certain that a single species encountering different conditions of life in different regions of the same lake will react accordingly. We shall be enormously surprised, for example, if such fish as yellow perch and lake herring do not differ as regards growth, age, size, spawning seasons, ... in Green Bay, north-eastern Lake Michigan, and southern Lake Michigan. Similarly, we have good evidence that lake herring of northern Lake Huron presents a different problem from that offered by the Saginaw Bay herring. Thus it appears that many of our 70 species-lake combinations may require subdivision into two or more parts. If we set the average number of stocks per species per lake arbitrarily at two, we have increased the number of commercially important stocks to 140. The figure could just as easily be 200.

Our estimates certainly have placed us in a nasty situation, for it is obvious that we cannot carry through 150-200 thoroughgoing fundamental studies, each to be followed by continuing research to keep us informed as to changing conditions. We must take measures--but what measures shall we take? When we have answered that question, we shall be well on the way toward setting up a program for the investigation of the principal stocks. A system of priorities is indicated; the form it takes must be flexible, changing as conditions change and as our background and experience grows. Certain general features can be described nevertheless.

1. We must defer temporarily or even indefinitely detailed studies on some species. For example, such fish as carp, suckers, and catfish are not now causing us any particular concern.
2. With the stocks that are to be investigated intensively and on a continuing basis, our selection must be founded on such factors as:
 - a. Productivity (actual and potential) and value of the fishery; that is, the more important species must come first and researches must be initiated in the principal centers of production.
 - b. Status of the fishery. How severely do the stocks seem to be depleted? How great is the threat to the stock from heavy fishing pressure and destructive fishing methods?
3. In minor centers of production and where threats to stock are not great, occasional checks--periodic or special as conditions dictate--may prove adequate.

Even the most careful grading and sorting of projects will, without doubt, leave us with an amount of work that will tax our proposed facilities to the limit. Should the expansion fail to materialize, we shall have to continue to hunt big game with a BB gun.

For an appalling number of stocks our investigations must start from scratch. For some, however, we have carried out certain basic studies that can serve as a point of departure. During past years we have made

a number of investigations that can be grouped loosely under the general designation of life-history studies. The content has varied widely according to the extent and nature of the information at hand. In the main, however, we have learned what we could about such points as:

1. Size and age composition of fish on the grounds. Where a series of collections has been at hand we have been able to gain some rough notion as to how size and age vary with gear of capture, season, and year and of the extent to which the strength of year classes may fluctuate.
2. Rate of growth, extent of annual and local variations; time required to attain legal size; age and size at sexual maturity.
3. Spawning season and grounds.
4. Length-weight relationship; ratios of various length measurements;
5. On occasion we have been able to include still other data; our studies of Lake Michigan chubs, for example, included information on bathymetric and geographical distribution and on regional differences of abundance.

These researches have been fundamental; yet, standing alone, their usefulness is greatly limited. They are in effect still pictures--panels cut from a moving-picture film. They can provide at best only a small hint of the changes that can and do occur within populations. No one realizes more keenly than we the inadequacy of this type of study. By the same token, no one is so sharply aware of the futility of attempting continuous studies of numerous stocks scattered over thousands of miles with an operating budget for field work of a few hundred dollars a year. Bitter circumstance has compelled us to limit our biological studies of stocks of fish to the laying of foundations on which to build at such time as we may be able to conduct research on a really adequate scale.

Even these so-called basic life-history studies have been made for only a fraction of the important stocks as the following summary of where we stand with the principal species will show:

Lake trout: No fundamental life-history study has been completed for any water. Only scattered information is at hand on such matters as growth, migration, food, sizes, etc; the extremely important question as to the alleged existence of many races has not been touched. Whether we can even use scales to identify age groups remains to be determined.

Lake herring: Thorough life-history study has been made in Lake Huron, particularly Saginaw Bay; one is in progress (we might call it frozen progress or suspended animation, as little additional work has been done for more than 10 years) in Lake Erie. Useful but scattered data on the natural history (distribution, spawning grounds, and seasons..) are available for all lakes. Almost nothing at all has been done in Lake Superior, which currently produces nearly 3/4 of our annual yield, or in Michigan or Ontario.

Whitefish: Life-history studies have been published or are in press for north-central Lake Huron and for Lake Erie. In other areas--Michigan, Superior, Ontario--nothing has been completed, and practically no material is at hand. A little information is available on movements in Lake Michigan on bathymetric distribution in Michigan and Huron, and on general features of the natural history in all lakes. A detailed historical and statistical report of the fishery in Lakes Huron and Michigan has been published--largely a post mortem on the havoc wrought by the deep trap net.

Chubs: Life-history studies have been completed for one of five species in Lake Superior, and for four of seven in Lake Michigan. We have excellent data of 1930-32 vintage on sizes, distribution, regional abundance in Lake Michigan but nothing more recent. Taxonomic studies and scattered investigations of the general natural history have been made in the four lakes containing chubs (they are absent from Lake Erie).

Walleye: Life-history studies are complete or well along in principal centers of production--Lake Erie and Saginaw Bay; nothing in lesser centers including Lake Ontario. Evaluation of artificial propagation has been made for Lakes Huron and Michigan.

Blue Pike: A life-history study has been completed in Lake Erie, where most are caught; no information is at hand for Ontario; blue pike are absent blue pike are absent from the three upper lakes.

Sauger: A life-history study has been carried out in Lake Erie, the chief center of production.

Yellow perch: Life-history studies have been conducted in the three principal centers of production--Lake Erie, Saginaw Bay and Green Bay. Nothing is known concerning yellow perch in the lesser centers, including Lake Ontario.

Suckers: Nothing is planned; nothing has been done.

Burbot: A study of food habits has been made for the smaller fish in Lake Michigan. The burbot is to be investigated only in its relation to other fish.

Carp: Nothing is planned; nothing has been done.

Sheepshead: A life-history study has been completed in Lake Erie where most are taken.

Catfish: Nothing is planned; nothing has been done.

Smelt: Some life-history data have been included in papers on spread distribution, and mortality. Thorough investigations are still to be made in all lakes.

White bass: A life-history study has been made in Lake Erie, the principal center of population.

From the preceding comments it is apparent that even the most elementary facts concerning the life history of many stocks remain to be worked out. Furthermore, as stated earlier, these still pictures--even if we had a complete file of them--standing alone are of greatly limited usefulness. We must learn more about the dynamics of the populations--fluctuations that occur, their extent and causes. Only this kind of information can serve as the basis of management techniques needed to rebuild depleted stocks, conserve the present supply--in general, promote the most efficient utilization of the resource.

To our still pictures, then, we must add moving pictures; we must place our major stocks under continuing observation. We can do so only with the expanded facilities that were described previously.

A detailed exposition of objectives and methods in our proposed continuing research on stocks of Great Lakes fish would be to no point. The ultimate goal and the broad plan of attack are much the same in all similar research. The procedural details are not subject to prediction. They must be fitted to specific conditions and adjusted in the light of continuing experiences.

Broadly, our situation on the Great Lakes is this: We have a few stocks that are highly productive because the fishery is recently developed (as with the Lake Superior herring) or because the stocks can resist heavy fishing pressure or possibly gain biological advantage from the decline of other species (as may be true for the walleye in Lake Erie and in Saginaw Bay). We want to keep these productions at the highest possible level. Other stocks, as the lake trout and yellow perch of Lake Michigan, have suffered moderate declines of production--about 20 or 30 percent. With them we must halt and reverse the downward trend. Still more numerous, we regret to say, are those stocks that are today yielding substantially less than half the quantity normally produced in past years--the lake trout in Huron and Ontario, the lake herring in every lake but Superior, the whitefish in Superior, Michigan, and Huron, the yellow perch in Huron and Ontario, With these fish we face the tedious and difficult task of rebuilding from a relatively small population.

Yet with all these stocks we have much the same problem--that of measuring fluctuations in abundance and evaluating the factors contributing thereto. The relative importance of each factor regardless of whether or not it is one over which we can exercise any degree of control must be determined as accurately as possible in order that we may judge better what results may be hoped for from specific management practices. Our program does not, for example, contemplate the increase of abundance through the ordering of more propitious weather. Yet a knowledge of the effects of meteorological conditions on the success of year classes is vital, for these uncontrollable factors place limits on what can be done with changes of minimum legal lengths, open and closed seasons, regulations on kind and amount of gear,

Much of our continuing investigation of stocks will, of course, be made in order to appraise the results of management practices that are placed in effect.

To this point we have mentioned principally investigations on individual stocks, for these studies will constitute a major part of our program. There are, nevertheless, other and extremely important problems. No fish, for example, could possibly get along without an environment and even the most unsociable cannot avoid having neighbors. Furthermore, knowledge of environmental conditions and of interrelationships among species can contribute tremendously to our study of factors of abundance. We propose to carry along as part of our research limnological investigations that will instruct us on such points as the effects of temperature and currents on the distribution and movements of fish, the distribution and abundance of food organisms, Past investigations on the limnology of the Great Lakes have been relatively limited. Our most thorough-going survey, made on Lake Erie, is unreported for the lack of funds for publication.

Among the most pressing questions on relationships among species that require early consideration are:

What is the role of the smelt as a predator, as a competitor, and as a source of fish food?

Does fishing for chubs deprive the valuable lake trout of its natural food?

Is the burbot a highly destructive predator on valuable species?

What is the relationship between fluctuations of blue pike and muskellunge?

The sport fisheries are another phase of Great Lakes fishing in which our information is only fragmentary. We do know that the catch of anglers on the lakes is far, far greater than is commonly supposed. Rough surveys on the connecting waters between Lakes Huron and Erie proved that the take of anglers there runs into hundreds of thousands of pounds annually; and in certain other areas we have reason to believe that sportsmen take more of some varieties than do commercial operators. Certainly the total catch of anglers in the lakes must run into millions of pounds--how many millions we cannot say.

The real importance of the sport fisheries is not to be measured, of course, in pounds of fish. The greatest value of these fisheries lies in the recreational facilities that they provide in one of the most densely populated regions of the country. Nor should we sell short the money value of the sport fisheries. The cash return to the communities per pound of fish taken by anglers is many times that for fish produced commercially. If we had records of the expenditures for equipment, baits, boats, tourist accommodations, ... we might well find that economically the sport fisheries of the Great Lakes are on a par with commercial operations.

We propose in so far as is possible to substitute information for speculation--to secure through surveys, creel censuses, biological studies of stocks of fish, etc.--data on the real extent and value of the sport fisheries, on the quality of angling, and on the management procedures that will best insure the expansion of the fisheries and the maintenance of their quality.

An entirely different aspect of the sport-fishing problem concerns conflicts of interest, real or imaginary, between anglers and commercial operators. We recognize the value of protecting sport fishing and fostering its development even if restrictions on commercial operations are required. On the other hand, we believe that the indiscriminate closure of areas to commercial fishing for the alleged protection of angling (made usually as the result of heavy local pressures and not based on actual information) has often been unsound. We have cause to suspect that these closures all too frequently have only established refuges for carp, suckers, and other coarse fish--to the detriment of anglers and commercial operators alike. We plan investigations on the closed waters to determine the actual status of the fish populations.

Still another line of investigation on the Great Lakes worthy of special mention is research with experimental gear. Experience has taught conclusively that the fishing action of a particular net or of a particular mesh size is a matter for observation rather than prediction, and that experimental fishing, to yield dependable results, must be planned carefully and carried out on a rather extensive scale. The experimental investigations that we have made (and some of the earliest, if not the earliest, work with "savings gear" on this continent was conducted on Lake Erie) yielded invaluable data--data that formed the basis of several highly desirable changes in regulations, particularly as regards mesh size. For many Great Lakes fisheries we now have good information as to the desirable legal specifications for different gears. Some important questions are still unanswered, however, (for example, controversy currently rages as to the proper mesh size of gill nets for taking lake herring), and changing conditions may call for renewal of experimentation.

Experimental operations designed primarily for the study of the fishing action of gears also yield valuable information on the distribution, abundance, and movements of fish and provide opportunities for the collection of better biological samples than can be secured from commercial catches.

Yet another aspect of experimental fishing concerns the development of gear (trawls, specially constructed nets, ...) for the sampling of stocks of young fish and for the development of new fisheries such as the smelt in open lakes. Extremely useful would be sampling techniques that would permit the detection of fluctuations in the natural abundance of fish well in advance of the attainment of commercial size. It would likewise be extremely useful if some method could be devised to catch smelt in the summer time for the market when they are subject to rapid decay and when normally they interfere with commercial fishing for other species by becoming entangled in large numbers in gill nets and rotting them.

Dependable fishery statistics that provide records not only of production but also of annual fluctuations in fishing intensity and in abundance (availability) constitute an indispensable part of the data needed for the scientific management of stocks of fish. Over a period of years we have developed methods of reporting and analysis of commercial fishery statistics designed expressly to fit the rather special conditions in the Great Lakes area. Our experiences in the State of Michigan, where statistics collected and analyzed according to our procedures are available back through 1929, have convinced us that we are able not only to detect all important changes in the fisheries but also to measure their extent with sufficient accuracy

to meet practical requirements. Our statistical methods are in use also in Wisconsin (beginning in 1936) and in part in Ohio and are being adopted by the Province of Ontario. An important goal in our program is the extension to all Great Lakes waters of uniform methods of gathering and analyzing fishery statistics.

Last place has been reserved here for the sea lamprey, the pest that will demand a large portion of our time and attention during the next several years and possibly longer. A native of Lake Ontario, the sea lamprey has now penetrated into all of the upper lakes. There is no evidence that it offers a serious problem in Lake Erie, but in Lakes Huron, Michigan, and Superior it threatens the very existence of the fishery for the valuable lake trout. The situation is especially alarming in Lake Huron where the production of lake trout has dropped from 1,372,000 pounds in 1939 to only 173,000 pounds in 1945. No major declines in yield are recorded for Lake Michigan, but widespread complaints are received (especially from the more northerly waters) concerning the high percentage of lake trout bearing scars from attacks by sea lampreys. In Lake Superior the sea lamprey has been reported as far west as Isle Royale, Michigan; that it will spread further westward, however, can be considered almost certain.

In recognition of the great threat of the sea lamprey menace, Congress has authorized the appropriation of funds up to a total of \$100,000 over a ten-year period for the control of this predator. If these funds are appropriated, we shall have primary responsibility for the planning and execution of a cooperative program (in which all Great Lakes states and the Province of Ontario are participating) for the development of methods of control.

The preceding outline of proposed research on the Great Lakes has, of necessity, been general. Details are to be filled in and the program modified in the light of future experience. No great changes are anticipated, however, in the over-all plan.

Rogers

COMMENTS

at the

CONFERENCE OF THE DIVISION OF FISHERY BIOLOGY
Washington, D. C.
January 27, 1947

Clarence Cottam, Assistant Director,
Fish and Wildlife Service

I am glad to have this opportunity to meet with the administrative leaders and principal scientists of the Division of Fishery Biology. I want to become better acquainted with this group and with the problems of this Division. I have already visited quite a number of the fishery research stations, and I have been much impressed with the fine quality of the personnel in this Division. I am compelled, therefore, to feel that if the Division is not functioning properly, this is because of a poor administrative set-up and not because of poor quality of personnel in the Division.

I am informed that this is the first time since about 1929 that all sections and units have been represented at a Division conference. I am a firm believer in holding such conferences, provided that we are big enough to recognize our own responsibilities and to take advantage of our opportunities. It is highly desirable that we meet in this conference, where any faults and unfavorable conditions in the Division can be pointed out and a plan developed for their correction. I might remind you that considering salaries, per diem, and other expenses, this conference is costing Uncle Sam more than \$8,000. Let us resolve to make the most of this, to make each penny count.

You have been called here to Washington because in our planning for the future we need the best thought of all the leaders and all the scientists of the Division. The fact that this Division has a total allotment of more than a million dollars carries with it grave responsibilities, yet it affords excellent opportunities for rendering a great public service. Are we big enough to measure up to this?

We must approach our problems objectively; in the tasks of this conference we must follow the true scientific method. We must be critical but strictly objective, keeping free of personal prejudice, rancor, or conclusions without factual basis. Let us form our conclusions on the basis of facts. We expect each of you to speak freely, frankly, and honestly. Because of the complexity of the problems confronting us, it will indeed be surprising if there is unanimity of opinion on every point; I want to assure you that the Director and his assistants do not expect this, but it is not unreasonable to expect and to demand unanimity of purpose. The responsibility and job at hand far transcend any personality or individual: no one has the right to think merely in terms of his personal interest. We must set our house in order and develop a more effective administrative set-up. Smug complacence is a sure sign of weakness and failure.

I want to urge that you take an objective look at yourselves as scientists and as administrators of your Division, as well as at your responsibilities as public servants. Is the money allotted and available to this Division being spent wisely? It is true that much has been accomplished by this Division and by most of you as research workers. However, we don't want to stress that aspect and make of this conference a gathering for self-approbation or a mutual-adulation society. We are here for serious business. Therefore, let us look at our faults and shortcomings in order to contrive means of making this a better functioning, more productive Division.

To correct any adverse condition, we must clearly recognize and define the fault. My contacts and responsibility with this Division have been too recent and perhaps too superficial for me to be sure just what are the major weaknesses of the Division. However, I have formed some opinions. I assume that Fishery Biology, like all other Divisions of the Service, has plenty of weak points and therefore room for improvement. To present a challenge and to stimulate your thinking, I should like to enumerate some of the points which seem to me to need correction.

As I see it, a major need is the creation of one effectively coordinated and closely knit Division from the more than 14 rather heterogeneous, uncoordinated, and apparently independent units now in existence. There are too many independent sections in this Division. I am in favor of local autonomy to whatever extent this is possible, provided that we can still maintain an effective administrative set-up which will function and cause all segments of the organization to work toward a planned objective and on a planned program. I have a feeling that the present administrative set-up in the Division of Fishery Biology is impracticable. Mr. Higgins has worked faithfully and hard, but I fear that the job of running such a big and complex Division cannot be handled by a Chief in Washington and an Assistant Chief in Chicago. These offices should be brought together at an early date. I believe that the Chief and Assistant Chief should have more assistants who are given both the responsibility and the authority (within specified and clearly defined limits) to act. Decisions should be made more promptly, and these decisions should be followed through to their proper fruition.

It is my candid opinion that this Division is weak in its administration, and I believe that this cannot be corrected until there is more manpower in the central office. I suspect that in the present understaffed condition of the Division its Chief is more or less compelled to spend too much of his time in handling too many details and therefore cannot have sufficient time for planning and thinking. An improved administrative set-up, including proper delegation of authority and responsibility to various members of the administrative staff, will afford better coordination both within and without the Division. This will enable the central office of the Division to keep the field better informed regarding budgets, allotments, policies, and decisions of the Division and of the Service.

I am convinced that in the Division of Fishery Biology, there is not enough contact between the central office and the field. Without close contact the central office cannot have full understanding of field problems and the needs of the field staff; without close contact, the field worker cannot understand or appreciate the restrictions, limitations, and problems under which the central office has to work. Obviously, supervision and administration may be faulty without this close contact. Also, without this close contact there is greater danger of duplication and poor coordination of research.

In addition to a good organization or administrative set-up, there must be the will to make the machinery work effectively. An effort must be made to develop a better morale. It is my opinion that the morale in Fishery Biology is not so good as it should be. The morale in this Division is probably poorer than that of most of the other Divisions of the Service.

I suspect that the Division of Fishery Biology needs to review more critically its objectives and its program. We need to develop a better sense of relative values and then have the wisdom to put first things first. We need to review our projects and determine whether we are working on primary or secondary problems. Are we following personal interests or public needs? Do we switch from one project to another in response to a personal whim or as the result of mature and considered decision that the change is in the best public interest?

I am in favor of a reasonable amount of "fundamental" research. This basic or primary research can be supported if we have the wisdom to pursue also the necessary short-term projects that will solve management problems that must be handled by administrators and those in operational work. As I see it, the chief difference between fundamental and the so-called "practical" research is largely a matter of time. If properly planned and pursued, the fundamental research is usually the most practical after a period of time.

There is too much of a tendency for the researcher to disregard his objective or planned assignment and follow an intriguing lead. Too frequently the research man seems to have no terminal facilities: his studies seem to go on endlessly without producing practical results. I believe this is the result of poor planning and poor supervision.

In my opinion, there is as much need for development of a clearly defined program of research as there is for the preparation of a blueprint prior to the construction of a house. A complex research program should be divided into its component parts or assignments, and each of these should then be pursued as an individual problem. This arrangement is comparable to the working plans prepared for the carpenter, mason, plasterer, plumber, electrician, and cabinetmaker. Though the work must be appropriately correlated, each assignment or job outline must be pursued to its conclusion or the house will never be ready for occupancy. If specific job assignments in research are properly outlined and followed to completion, there will be more accomplishments and more beneficial results.

Cost accounting on these specific job assignments is strongly advised. I have seen it tried, and I know it will work. If this cost accounting is kept on a simplified basis, it will take but little time and will help to keep the research on the beam. It will help any worker to be more critical of his own work and therefore stimulate better thinking. Such a system can be of great assistance, also in making an appraisal of the value of an assignment and of each research worker.

There is need for frequent analysis of data secured by the research worker. I firmly believe that all responsible supervisory officers and administrators should insist upon frequent review of assigned projects and analysis of accumulated data. A critical review of each project should be made at least once every year. If my impressions are correct, your files are bulging with data that have never been properly analyzed or written up. Yes, and I am quite sure that this Division could list a number of research assignments carried on (at least intermittently) for years without even a report being written or with very little information submitted to our central office. All or most of the facts and accomplishments in these circumstances are known only to the research worker, and too often they die with him or are lost when he leaves the Service.

I consider it advisable that each research worker, as a means of assembling and reviewing his data, make at least one rather detailed write-up of each of his assignments or projects every year. When conditions permit and when data are sufficiently complete, such a write-up might just as well be in the form of a paper for publication. Good, mature publications will build both the individual and the Service and at the same time give the public more for its money. I believe it advisable to arrange the program so that each research worker will always, in so far as possible, be working toward some major problem and good publication. I am of the opinion that at least in recent years the Division of Fishery Biology has not been sufficiently concerned about publications.

These are some of the points that have come to my attention in connection with the Division of Fishery Biology. I feel that correction of these conditions will go a long way toward increasing the contribution of this Division.

ADDRESS OF WELCOME

to the

CONFERENCE OF THE DIVISION OF FISHERY BIOLOGY
Washington, D. C.
January 27, 1947

Albert M. Day, Director
Fish and Wildlife Service

It is a pleasure to welcome you to this conference of the Division of Fishery Biology. It has been quite a while since you were called together for a conference of this nature, and I am pleased that circumstances now permit the holding of this meeting. I am quite a believer in conferences. It has been my experience that we can do a better job for the American public if we get together occasionally to exchange ideas, to tell our troubles to each other, and to be able to tell our higher-ups just what we think about how the work is going.

We make a practice of holding conferences of the Regional Directors twice every year. In fact, I have just come from our mid-winter conference in Chicago. Experience has shown that these meetings go a long way toward clearing up the troublesome problems that continually arise in the shifting requirements of a large organization. Other divisions have been holding conferences of this nature, so I am sure you will find this meeting helpful.

Insofar as the over-all picture is concerned, I may say that the Fish and Wildlife Service is in a good position within the Interior Department. Secretary Krug has demonstrated that he is very much interested in the problems of this Service. Under Secretary Oscar Chapman has a fine understanding of our problems, having handled them rather intimately for the past 14 years. Assistant Secretary Warner Gardner has shown keen insight into the problems of the Service, particularly those dealing with Alaska, and Assistant Secretary Davidson has also shown interest in our work. For this reason I say that we are in an excellent position within the Department which goes a long way towards better understanding with the Congress.

There has been considerable effort within the Department of recent months to establish Regional Coordination Committees to see that the work of this Service is correlated with that of other Bureaus. While this has taken considerable time, it has in some instances resulted in a closer coordination of field activities as well as in Washington.

So far as the new Congress is concerned, we are still uncertain of many of their actions which will influence the work we are able to do for the next year. I refer specifically to appropriations. The Appropriations Subcommittee, which will hear our request for funds, consists of Mr. Robert F. Jones of Ohio, as Chairman, Ben Jensen of Iowa, Ivor Fenton of Pennsylvania, Lowell Stockman of Oregon, Michael Kirwan of Ohio, W.F. Norrell of Arkansas, and Albert Gore of Tennessee. I would venture a guess that this committee will be more businesslike in the hearings than was the case under the previous chairman who happened to be Jed Johnson of Oklahoma. I would guess, however, that we may be requested to furnish a great deal more in the way of statistical information than we have ever done in the past. The chairman has a background as an accountant and will probably demand a great deal more in the way of statistics than we have ever had to furnish before.

Insofar as legislation is concerned, the bills in which we are interested will come before the Merchant Marine and Fisheries Committee in the House, of which Fred Bradley of Michigan is chairman. He has a good knowledge of fisheries problems, has been on the committee for many years, and has a deep interest in the Great Lakes fisheries. He has broken the main committee down into several subcommittees that will hear specific legislative matters pertaining to fresh-water fisheries, salt-water fisheries, and wildlife conservation.

As to appropriations, I may say that the Service fared quite well with the Bureau of the Budget, particularly in view of the strict budget policy prescribed by the President. Insofar as this Division is concerned the only increases granted were \$20,000 for the control of sea lampreys in the Great Lakes, \$54,000 for 9 months' operation of the Albatross III, and \$92,000 for fishery studies in the Columbia River Basin and Central Valley.

There has been considerable progress in connection with River Basin studies since the passage of the revised Coordination Act last year. For this fiscal year we received \$100,000 for general River Basin Studies exclusive of the Missouri Basin, the Columbia River and Central Valleys. This for the first time in history gave the Service an outright appropriation to study River Basin developments. The Budget Bureau granted an increase in the '48 budget of \$250,000, making our request \$350,000. Speaking of money, I think I should tell you that there is no money that is so hard to get and so hard to hold as research funds. We know that research needs to be continuous to keep abreast of ever-changing situations and fluctuating conditions. We deal with elusive creatures, fish and birds and beasts that cannot be kept in corrals or glass cages where we could watch their every movement. Our studies are complex and they need to be done over long periods by trained people. Yet it is most difficult to get this story over to the legislators and to the average individual who feels that this Service after conducting research for all of the years we have been in operation should now have answers to

these various problems. For that reason, unless I miss my guess, we are going to have great difficulty in holding appropriations for research work. This means that we must make sure that every dollar we spend for research is doing the best job it can. I fear that this division has been lacking in the correlation and supervision that go to make a closely knit organization. This has been due to various circumstances chargeable to the pressure of the last few years, but it is something that I hope we will seriously consider to make sure that our efforts in research are as productive as possible.

Again, I wish to say I am glad to see you here and hope you have an enjoyable and profitable conference.

